IULTCS Congress
XXXVI Ethiopia
2021 - Africa

3rd-5th November 2021

Greening the Leather Value chain

PROCEEDING BOOK OF ABSTRACTS

Africa Leather and Leather Products Institute - ALLPI

International Union of Leather Technologists and Chemists Societies

https://iultacsAfrica2021.allpi.int


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PROCEEDING BOOK OF ABSTRACTS

November 3rd – 5th, 2021

XXXV IULTCS Congress
(Congress of the international Union of Leather Technologists and Chemists Societies)

Addis Ababa — Ethiopia

His Excellency Tarekign Bululta

State Minister

Manufacturing Industry Competitiveness and Development Sector

Distinguished Mr Jean-Pierre GUALINO,
The International Union for Leather Technologists and Chemists Societies, President,
Excellency Ambassadors and Heads of Delegation Distinguished International Union for Leather Technologists Secretariat Members, Researchers, Colleagues,
Distinguished participants;
Distinguished participants, and guest speakers,

On behalf of the Federal Democratic Republic of Ethiopia, the Ministry of Industry and on my own behalf, I welcome all of you who are physically present here at the at the congress hall, in the beautiful city of Addis Ababa, and those of you who joined virtually from around the globe.
My country, Ethiopia, is honored to host this prestigious global event, organized for the second time in African, in the Union's more than 120 years of existence.
As all we agree, the leather sector and textiles are the quick win sectors, which helped many of the developed countries to transform their economies. Africa holds nearly a quarter of the global livestock population that constitutes bases for the leather industry development. My country Ethiopia ranks first in Africa and 10th in the world in terms of livestock number. However, revenue generated from this huge natural resource, is very limited due to limited value addition and linkages to the global value chain at commodity level.

Ladies and Gentlemen,

our national development plans the leather and leather products manufacturing sector has been identified as a priority sector and the government has been supporting this sector especially during the COVID 19 pandemic which disrupted the global market.
I have noted form the agenda of 36 Congress that, with the theme of "Greening the Leather Value Chain, the Congress will be focusing on science and technology surrounding the making of leather. Considering the complexity of the global leather value chain with regards to the required deep knowledge in science and technology and

environmental concerns, I am confident that the exciting line-up of speakers will share interesting and valuable information on the pressing global issues challenging the leather sector development. Continued creativity and innovation in the leather industry will improve the image of the global tanning industry, especially with regard to pollution and environmental sustainability.

As all we agree, arrangements for a Congress of this sort, particularly with the prevailing COVID-19 pandemic situation, are very complex and challenging. Thus, my special word of thanks goes to the Africa Leather and Leather Products Institute for successfully organizing the Congress. I also thank all of you who have contributed, in one way or another, to make the Congress a reality.

Distinguished guests and participants,

Let me now conclude by expressing, sincere wish that the discussions and deliberations resulting from the three days Congress to come will positively contribute to the consolidation of the aims of the IULTCS and thereby to enhance the development and sustainability of the leather industry. it is now my great pleasure to declare this congress officially opens on a Hybrid mode from Addis Ababa and wishing you a delightful and stimulating Congress,

Thank you,

Welcome Message from ALLPI Acting Executive Director

Mr. Ghebregziabher Ghebremedhin
Acting Executive Director & Programms Coordinator of
Africa Leather and Leather Products Institute (ALLPI)

His Excellency Mr Tarekegn Bululta, State Minster, Ministry of Industry,
Distinguished Mr Jean-Pierre GUALINO, IULTCS President,
Excellency Ambassadors and Heads of Delegations,
Distinguished IULTCS Secretariat Members, Speakers, Colleagues,
Distinguished participants;
All Protocols Observed.

A very welcome to all of you and would like thank you for joining the XXXVIth IULTCS Congress.

On behalf of Africa Leather & Leather Products Institute I would like to present my compliments to all participating in this opening ceremony and express to you my deep satisfaction for sharing this important moment for which I believe will contribute to the development of the leather sector.

To the oral and poster speakers, delegates and to all participants who are participating either physically or virtually I am greatly honored and pleased to welcome you to Addis Ababa or to the congress's virtual platform on behalf of Africa Leather & Leather Products Institute. We are indeed honoured to have you in the congress.

We have about 300 participants from all over the world gathered today, making Addis Ababa truly an International leather city. This gathering of the leather scientists, technologists and the leather family here in Addis Ababa is an opportunity for Africa leather sector to bridge the gap of the development of the leather sector and enable establish net working with the global players. This congress is special occasion for ALLPI and Africa leather sector. It will be an occasion to meet discuss to learn and to plan for the future development of the leather sector in Africa.

The 36th IULTCS Congress is organized by ALLPI in collaboration with the government of Federal Republic of Ethiopia. The organizing committee has done an excellent work in preparing the Congress, I would like to thank them for their commitment and competence during the organization process. I would like to thank Professor Mekonnen Hailemariam not only for his tireless works in the preparation of the Congresses but also for his leadership during the preparation of the organization of the Congress.

I would like to thank the government of the Federal Republic of Ethiopia in general and especially for the Ministry of Industry, LIDI for travelling with us in all the preparations of the Congress as co-hosts. Special thanks go to IULTCS secretariat in general and to Dr Luis Zugano and Dr. Anscombe specifically for without their support the realization of the congress would have been hard to realize. Thank you so much!

We are fortunate to have the support of a great cadre of sponsors, whom I hope you will get to meet here in the Congress Hall or on the Congress Virtual Platform during the duration of the Congress. As Gold Sponsor we have TFL. As Silver Sponsor we have Pittards Global. As Bronze sponsor we have ATC, Cromogenia unit, Buckman International, CICB and ELICO. We would like also to thank our media partners.

The XXXVIth IULTCS is organized under the theme "Greening the Leather Value Chain" with the implication that the congress's scientific papers will concentrate on scientific processes of the renewable resources and environmental concerns.

We have today with us leather technologists, chemists, academicians and leather professionals. I hope that these three days congress allows the leather technologists, chemists and leather professionals to share, discuss and answer to the current challenges in the leather sector.

With these few words I hope the conducting of this congress in Addis Ababa Ethiopia will contribute to the opening up of new net works, broader cooperation and more integration of the leather sector in general and Africa in particular.

I also wish for those who are attending the congress physically an interesting and pleasant stay in Addis Ababa and for those attending the congress virtually I wish them all the best where ever they are.

Mr. Ghebregziabher Ghebremedhin
Thank you very much

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Welcome Message from IULTCS President

Dr. Luis A. Zugno
IULTCS President

Dear IULTCS colleagues,
On the behalf of all the IULTCS members, I would like to extend a warm welcome to all participants of the XXXVI IULTCS Congress.
For three days Addis Ababa will be the scientific Leather center of the world. Our congress offers a superb opportunity to all participants to share world-class technical knowledge, information, networking and experiences.
Our strong Scientific Program is a good balance of basic research, applied technology, new applications, environmental and sustainability work. We thank all the authors that made the effort to submit abstracts and making the presentations (oral and visual) that will make an impact now at this Congress and in the years to come. Your presence here should be a motivator to continue working on the Leather science.
We thank to all the organizers and sponsors, particularly Prof. Hailemarian and his team, for the four years of commitment, dedication and hard work to make this Congress to happen. You all should be proud of the great work you have done.
Today the hybrid venue is the best choice for a successful event; we will still connect as a global community. Let's make the best out of this event. Leather is our passion and we all are glad for the opportunity to be here to make our contribution.
Thank you for your participation and work. Welcome to a great Congress.

Keep Tanning!

IULTCS

International Union of Leather

Technologists and Chemists Societies

IULTCS Congress XXXVI Ethiopia 2021 - Africa

3rd-5th Nov. 2021

Congress Organizers

Africa Leather and Leather Products Institute - ALLPI

International Union of Leather Technologists and Chemists Societies

Leather Industry Development Institute - LIDI

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Greening the Leather Value chain

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The IULTCS

The International Union of Leather Technologists and Chemists Societies, a world-wide organization of professional societies, was originally organized in London in 1897. There are currently 18 Member Societies and 5 Associate Members representing some 3000 individual members.

According to the IULTCS statutes the aims of the Union are to foster cooperation between member societies, to hold congresses to further the advancement of leather science and technology, to form commissions for special studies and to establish international methods of samples and testing leather and materials associated with leather manufacture.

The IULTCS organization has held 35 Congresses in nineteen different countries on five continents. In 2021 the IULTCS will add another new country when the Congress will be held in Ethiopia.

A brief history of the union

In September 1897 on the initiative of Professor H. R. Procter (Yorkshire College, Leeds), Dr. J. Gordon Parker (Leather Laboratories, Herold's Institute, London), Mr. A. Seymour Jones (Leather Manufacturer, Wrexham) and Mr. C. E. Parker (Penketh Tanner, Warrington), a three day conference of leather trades chemists was arranged and

held in London. At least 200 people took part in the conference and present were chemists from Austria, Denmark, France, Germany, Hungary, Great Britain and Sweden.

On September 29th, 1897 the originators of the conference constituted themselves into the first International Association of Leather Trades Chemists and specified the conditions

for joining. They then invited applications for membership. Mr. Seymour Jones (Great Britain) and Mr. Franz Kathreiner (Germany) were elected President and Vice-President respectively.

The business of the conference largely centred around vegetable tanning materials and their analysis, but reference was made to use of lime in unhairing and its removal from skins. It is interesting to note that special mention was made of the necessity to deal with the polluting effects of tannery effluents. By 1911, ten countries were represented in the Association and the membership had grown to 414. The Association's journal, Collegium, under the editorship of F. Kathreiner, appeared in 1897 and became a multi-lingual independent publication in 1902.

It is not possible to reference all the early pioneers who supported the Association before 1914 but the following, in addition to those mentioned above are worthy of special mention by virtue of their outstanding work in the field of leather chemistry and technology. M.C. Lamb, E. Stiasny, F.H. Haenlein, H. Becker, W. Fahrion, K. Schorlemmer, L. Meunier, A. de la Buere, G. Abt, U.J. Thuau, P. Chambard, W. Eitner, B. Kohnstein, G. Grasser, J. Jedlicka, L. Pollack, E. Andreis, R. Lepetit, G. Baldracco, E. Schiaparelli, A. Gansser, E. Nihoul, D. Wauters, A.W. Hoppenstedt, H.C. Reed, H.C. Small and W. R. Alsop.

In 1917, due to hostilities, the members were divided into two groups. One group under the name "Internationaler Verein der Lederindustrie Chemiker (IVLIC); covered Germany, Austria, Hungary, Holland and Scandinavia. The other group, from 1925 under the name International Society of Leather Trades Chemists (ISLTC) covered Great Britain (and the Commonwealth), France Italy and Belgium. Switzerland (VESLIC) and the USSR formed their own societies, but the American Leather Chemists Association (ALCA) had already been in existence since 1906.

From 1926 joint discussions took place between members of the IVLIC and the ISLTC. Later the following joint conferences were held – Basle (1931), Amsterdam (1933), Brussels (1935) and Copenhagen (1937).

In 1946 the British Section of the ISLTC put forward a proposal that there should be a federation of separate autonomous national societies. The Executive Committee of the ISLTC agreed to this and on January 1st 1948 the Internal Union of Leather Chemists' Societies (IULCS) was instituted simultaneously with the dissolution of the ISLTC.

A draft constitution was prepared and this was first published as "The International Union of Leather Chemists' Societies (IULTCS) Provisional Statutes 1948". This was approved with minor amendments by the first meeting of the Council of Delegates in Paris on September 26th 1949. (Further amendments to the Statutes have been approved since then.).

The first meeting of the provisional Executive Committee of the newly constituted IULCS was held in Leeds on September 16th 1948 when Belgian, British and French societies formally declared founder members and applications for admission were considered (and approved) from the leather chemists societies of Holland, Italy and Switzerland. The first provisional Executive Committee of the IULCS under the presidency of Professor Dr. P. Chambard, was confirmed in office by the Council of Delegates in September 1949.

The first Congress of the Union was held in Paris during the period September 25th-30th, 1949 by which time the American Leather Chemists Association had accepted an invitation to join. Soon the Czechoslovak and

Nordik Societies had expressed a desire to join the Union and approaches had been made by various individuals from the leather chemists societies of Argentina, Germany and Spain.

By the tie of the London congress in September 1951 under the presidency of Mr. M. R. Blockey, ten national societies had officially joined the Union, though in fact representatives from 15 countries were present. In 1983 there were 28 member societies and the Union covered the whole world from Japan to Argentina and Poland to India.

The present title of the Union, The International Union of Leather Technologist and Chemists Societies (IULTCS) was approved by the council of Delegates of the IULCS at the Congress in Vienna in 1973.

There has been only one break in the two-year cycle for Congresses since 1949. There was a four year span between Venice in 1983 and Melbourne in 1987 and the IULTCS recognized that this was to long and the two-year spread was re-instituted.

In 1997 the IULTCS reached the end of its first century. The IULTCS celebrated its 100 years with an outstanding Congress held in London, the site of the very first meeting. Over the last two decades there have been some large shifts in the locations of leather manufacturing facilities and in the shoe manufacturing. Regions that have a long tradition of research in leather processing are seeing large reductions in the leather industry. While many of those areas that are rapidly increasing in leather production do not have appropriate leather chemists and technologists societies. If the IULTCS is to continue to prosper into its second century, changes will be needed in the organization. The first steps have been taken with the formation of a permanent secretariat. The next will be to encourage the new leather manufacturing regions to join the IULTCS and reap the benefits of our Union.

Africa Leather and Leather
Products Institute (ALLPI)

ABOUT ALLPI

Africa Leather and Leather Products Institute (ALLPI), formerly COMESA – Leather and Leather Products Institute (COMESA/LLPI), is an intergovernmental organization established through a Charter signed by 17 heads of State of COMESA Countries in 1990. Its mandate was to facilitate the development of the leather sector in the Common Market for Eastern and Southern Africa (COMESA) region prior to its rebranding. However, with re-branding through a Summit communiqué, its mandate was widened geographically to cover the entire African Continent, with its mandate remaining as enshrined in its founding charter. The African outreach will align to the attainment of Agenda 2063 and also create value towards the Continental Free Trade Area (CFTA) and Tripartite structure.

Africa Leather and Leather Products Institute (ALLPI) is currently implementing its 10 year Strategic plan (2016 to 2025) which aims at transforming the continent's leather sector from production and export of raw materials to production and export of finished products and enhance the leather sector trade integration under CFTA and Tripartite structure. The Strategic plan, is aligned with the AU agenda 2063 and Sustainable Development Goals (SDGs). Its involvement of Public, Private Sector and the Academia ("Triple Helix") is contributing toward transforming the livelihoods in Africa through sustainable leather sector development through value addition, enhanced productivity and competitiveness.

In order to address the long-standing weakness in product development, design and fashion forecast in the leather sector, ALLPI has also embarked on an ambitious Flagship program the Regional Design Studio with satellite studios in member countries. The program was initiated in 2015 and to date satellite design studios are set up in 6 member countries. The development of design capacity is expected to enhance the exportability and competitiveness of the Continent's leather sector.

ALLPI is also occupying a pivotal place in continental and global fora that deal with the leather sector. It is serving as a specialized institute for the leather sector in the African Union Commodity Strategy Development, partnering in the organization of All Africa Leather Fair (AALF), serving as Member and Vice President of the International Council of Tanners (ICT) and an Executive Member of the International Unions of Leather Technologist and Chemists Society (IULTCS).

Gold Sponsor

TFL is a globally operating company producing specialty chemicals for the leather industry and related industries. TFL offers its innovative products and solutions to tanneries, leather processing companies and coaters, always striving to introduce fresh ideas to the market. Our business activities comprise the development, production and marketing of specialty chemicals such as tanning agents, dyestuffs and finishing products, which enable our customers, mainly tanneries, to create an attractive end article such as leather automotive interior.

02.2020

Oral Presentations

001 Metal Organic Framework - Layered Double Hydroxide: improve the absorption of chemicals in wet leather processing

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ABSTRACT: Metal Organic Framework-Layered Double Hydroxide (MOF-LDH) is a type of multistage structure material that has both the LDH laminate structure and the MOF porous cavity structure, which has excellent adsorption performance due to the controllability of interlayer anions of the LDH and the porous cavity structure of the MOF. In this study, MOF-LDH with multistage structure was designed and synthesized. XPs and BET results showed that the MOF-LDH has good crystal structure and its specific area was 20.60m2g-1. SEM, TEM showed that the size of MOF-LDH was about 100 nm with surface had obvious convex polyhedral structure. It was used in leather tanning process with 2% chrome tanning agent. Tanning, dyeing and fatliquoring properties were investigated. The results showed that, compared with 2% chrome tanned leather, the shrinkage temperature of leather tanned with MOF-LDH and 2% chrome tanning agent increased from 73 ℃ to 89 ℃ , the L value decreased from 24.5 to 23 and the absorption rate of dyes could increase from 87% to 92%, the softness increased from 8.0mm to 9.5mm and the absorption rate of fatliquor could be increased from 88% to 94%. Synthesis and application of MOF-LDH is helpful to the development of cleaning process and provide a new method for less chromium tanning and efficient adsorption of anionic cations in wet processing of leather.

002 Dehairing process through combination of oxidative and enzymatic approach: Sustainable technology for leather industry

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ABSTRACT: In this work, the dehairing of goat skins using oxidative chemicals and protease enzyme has been attempted. As conventional dehairing system emanates huge pollution loads in terms of Bio-Chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), the developed method is simple and efficient that brings out the desirable qualities of dehairing. The complete dehairing for the goat skin was achieved using oxidative chemical 1% and enzyme 1% with the duration of 10-12 hours. The pollution loads in terms of BOD, COD and Total Dissolved Solids (TDS) were reduced up to the level of 44, 35 and 51% respectively in comparison with the control sample. In addition to that, the leather produced from this method was comparable and hasn't shown any adverse remarks in the organoleptic properties of leather. Besides, another advantage of this method is that the processing time for leather making is considerably reduced by skipping reliming and deliming processes. A mechanistic mathematical model describing the diffusion reaction phenomena of dehairing agent through pores of skin has been developed that supports monolayer adsorption by Langmuir isotherm. The crust leather made in this process showed improved uptake of colour with that of control sample. The physical strength properties of the experimental leather were comparable with that of conventionally produced leather.

Key words:

› *Oxidative-enzymatic dehairing, Mathematical modelling, Reduction of BOD & COD, Improved colour and organoleptic properties of leather*

003 Patagonian fish skin tanning processes

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ABSTRACT: The ancient tradition of using fish skin to make garments and accessories was shared by several Arctic coastal societies as part of their subsistence lifestyle that relied on aquatic resources for both nourishment and clothing. Antarctica is not populated, but the Tehuelche, Selkam, Yaghan and Alakaluf are some of the southernmost Indigenous Peoples in the world, closest to Antarctica. They live in the Patagonian region of southern Argentina, Chile and the islands of Tierra del Fuego. They fish and hunt animals whose migrations in Antarctica are a critical component of their survival. There is not much literature on the use of fish skin by the Indigenous Peoples of Patagonia, but they were known to use sea cow skins to make clothing and blankets to keep them warm and protected against the elements. Tehuelche women smeared sea cow hides with chewed liver and then tanned them by hand, rubbing them vigorously. This paper evaluates the traditional Tehuelche hide tanning process developed on fish skins by agronomist Fabian Trachter in Patagonia, using a process easily adaptable to any location. The tanning was performed with Mimosa extract and without machinery, allowing the development of fish skin tanning in areas where electricity is scarce. The method is not intended to rule out the use of drums, vats or drying tanks, but to demonstrate that it is also possible to tan without them. The results are compared with those of commercially tanned fish leather to identify the traditional tanning process with a very low environmental impact.

004 Preparation and application of polyether amine triazine derivatives as a chrome-free tanning agent for cleaner production

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ABSTRACT: In this work, a polyether amine triazine derivatives (ET) was prepared via one-step process and its structure was confirmed using FT-IR, 1H NMR analyses. Then, the ET was applied to the tanning process and a novel chrome-free tanning approach has been optimized and evaluated. The result indicated that after tanning with 8% of ET at pH6 for 6h, the shrinkage temperature of leather was 83.9 ℃ and the thickness change rate was 97.5%. The ET tanned leather was endowed with a close mechanical and organoleptic performance as conventional chrome tanned leather. The XRD, DSC, TG, SEM and Zeta potential analyses demonstrated that ET could couple with the amino group of collagen side chain and breaking partial hydrogen bond between fibers, brought significantly improvement to the softness of leather, but has no impact on the high-level structure of collagen. Another promising features of this tanning approach is that the residual Cl- concentration in wastewater decreased 42.1% in tanning process compared to conventional chrome tanning method. The emissions of COD and TDS in tanning process reduced by 40.5% and 27.2%, respectively. It is conceivable that the ET tanning approach satisfactorily solves the longstanding problems of conventional chrome tanning and provides an improved approach to promote leather industry to develop sustainably.

005 Study on Construction and Properties of Self-cleaning Leather

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ABSTRACT: The Self-cleaning leather was constructed according the bionic principle of super hydrophobic coating. Specifically Silicon dioxide (SiO2) nanoparticles were modified by epoxy groups by Atom Transfer Radical Polymerization (Atom Transfer Radical Polymerization, ATRP), which were finished on the leather surface to form a permanent super hydrophobic layer. Static waterproof, water vapor permeability, surface contact Angle and coating wear resistance experiments were evaluated the performance of leather, the results show that the surface contact Angle of leather can be increased from 117.56 ° to 151.17 °, static waterproof effect can be kept for a long time. All other tested indexes are in line with the usage requirements of abrasive leather.

Key words:

› *super hydrophobic coating, self-cleaning leather, waterproof.*

006 The effect of retanning on the biodegradability of leathers

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ABSTRACT: A fully biodegradable half tannage, using organically masked sodium aluminium silicates, produces a semi-processed tanned leather that fully disintegrates in less than 20 days (when tested using a modified ISO 20200: 2015 disintegration test). The wet, thinned, biodegradable semi-processed leathers were then treated with chemicals of differing degrees of biodegradability from three retanning chemistry classes (vegetable tannin, aldehydic, and syntan). The results of the research show that as retanning chemical complexity increases, the ultimate biodegradability (as measured by ISO 20136: 2020), and the disintegration (as measured by ISO 20200), decreases. Considerations of the biodegradability and disintegration, within the results of this research, are linked to the microbiology limitations of current test methods and known data of tanning substances biodegradability. Considering these results, the paper will review the current state of knowledge on the existing retanning types and will aim to assist tanners with their future selection of biodegradable chemistry.

007 Unhairing Systems Comparison

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ABSTRACT: Unhairing Systems Comparison Traditional Hair Burn Process vs Hair Saving with sulphide vs hair saving NO Sulphide Beamhouse processes are renowned for being amongst the most polluting processes in leather production, we present a system to reduce TDS, COD, BOD and sulphides, while allowing reuse of the float, giving better total water consumption. TRADITIONAL HAIR REMOVAL PROCESS In the conventional liming – hair burning process, the liming chemicals either destroy the hair and epidermis completely or loosen them to such an extent that they can be removed mechanically HAIR SAVING PROCESS The hair-save process uses the same chemicals as the hair-burning system (lime and sulphide) applied differently The principle of the method is the hair fiber is firstly partially protected by lime them sulphides (sulphides or hydrosulphides) added to attack the hair roots, thus allowing the hair to be recovered by a filtration and collection process. ADVANTAGES OF HAIR SAVING PROCESS Lower Total Dissolved Solid content

008 Waste leather scraps hydrolysate: a high quality multidentate ligand for in situ growth of highly-stable CsSnCl3 perovskite quantum dots

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ABSTRACT: Perovskite nanocrystals(NCs) have attracted wide attention due to their superior photoelectric properties. However, the lead halide perovskite NCs, which are the most studied at present, are controversial for their high lead content. Tin is expected to replace lead for preparing perovskite NCs because of its similar outermost electronic structure. However, the environmental stability of tin-based perovskite NCs is poor, which leads to its limited application. Using natural gelatin to passivate and coat tin-based perovskite NCs to improve their stability has been proved in our previous work. Waste leather scraps are hazardous wastes, but they also have the advantages of high collagen content. It is extremely urgent to realize the harmless clean treatment and resource utilization of such waste leather scraps. Herein, we proposed a new strategy that tin-based perovskite NCs was prepared with ionic liquid [AMIM] Cl as solvent and antioxidant, hydrolysate of waste leather scraps as multidentate ligand and coating material. The characterization results of TEM, EDX and FT-IR showed that the rich active groups in the hydrolysate of waste leather scraps serve as multidentate ligand to passivate the NCs. And the long molecular chain of hydrolysate of waste leather scraps could coat the perovskite NCs, isolate the environment and further improve its stability. The PL and XPS results showed that the tin-based perovskite NCs had excellent water resistance, ultraviolet resistance, oxidation resistance and mildew resistance. When the tin-based perovskite NCs were treated with water and ultraviolet rays, the residual fluorescence intensity within 72 h was still above 70%.

009 Fabrication of epoxy leather sheet: A novel approach in waste management in leather industry

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ABSTRACT: The leather product industries creates enormous amount of solid leather scraps waste with chromium content and tanned chemicals, being classified as a hazardous waste leads to environmental contamination. Epoxy leather sheet (ELS) were prepared using a technique for hand lay-up and characterized using to their physico-chemical and mechanical properties. Epoxy leather sheet were examined physic-chemically analysis. The research paper confers in detail the applicability of these epoxy leather sheet in marine, automobile and future trends.

010 Microbial degradation of animal hair and preparation of organic compost thereof

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ABSTRACT: About 50 tons of hair waste is generated from the tanning industries on the processing of every 1000 tons of hides/skins. The disposal of hair wastes results in many significant negative environmental impacts. Keratin has a wide range of applications in the agricultural, cosmetic, and pharmaceutical industries. The keratin-rich hair waste is recalcitrant and its degradation is laggard. CSIR-CLRI developed a bioprocess technology for efficient degradation of hair using a novel bacterial strain, Brevibacterium luteolum MTCC 5982 in liquid medium containing salts and animal hair. The process was standardized in flask level and scaled up to 500 L in 750 L fermentor. The resulting fermentation liquor was used for the manufacturing of organic compost. The process could be completed within a time period of 10 to 12 days as against the conventional composting period of 90 days. Pilot scale production of compost has been standardized and the efficacy of the product has been tested at field level. The compost could serve as an effective organic fertilizer and could increase the yield of paddy by 20±5% and horticultural crops of bhendi, chilli and amaranthus by 25±5%. The process provides viable technological solutions to address the issue of tannery hair waste disposal on one hand and ensure financial returns on the other hand. The bulk production of compost from hair wastes could reduce the import and consumption of chemical fertilizers. This is an exemplary model of circular economy as the waste of the tannery industry serves as an organic fertilizer of the agricultural industry.

011 BIOLOGICAL LIQUEFACTION AND ANAEROBIC DIGESTION OF WASTE FLESHINGS INTEGRATED WITH SLUDGE AND BIO-ENERGY GENERATION – A NOVEL AND SUSTAINABLE DEVELOPMENT

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ABSTRACT: Safe disposal of large amount of solid wastes from tanneries such as unutilized fleshing and sludge from effluent treatment plants are major challenges and disposal of sludge in the Secure Land Fill (SLF) system is becoming prohibitive and environmentally challenging. The tanneries in Asia, process 8 to 9 million tons of hides and skins per year and generate 3 to 4 million tons of solid waste and 2.5 to 3.5 million tons/year of dewatered sludge from effluent treatment plant. The disposal of sludge and solid waste especially about 1.0 million tons of fleshing are becoming a major environmental challenge. The studies of biological liquefaction of waste / unutilized fleshing in pilot scale by mixing with active bio-sludge / liquid from Anaerobic Digester, kept in slow mixing for fermentation & liquefaction with a detention time of 7-8 days under atmosphere temperature of 20-35oC. Biologically liquefied fleshing is mixed with bio-sludge from effluent treatment plant with 4-6% solids concentration. The Anaerobic Digester with detention time of 30 days generates 0.5m3 of bio-gas per kg of COD removal. The bio-gas is collected and stored in gas balloon and further converted into electricity using Gas Engine. The digested sludge is dewatered and converted into fertilizer by the composting process. An Anaerobic Digester with 1.5 MLD holding capacity is capable of generating 500 to 600 m3 of bio-gas for conversion into electricity. This unique and sustainable technological development which is first of its kind in the World Leather Sector will reduce the hazardous category sludge volume generation and environmental issues in the disposal of unutilized fleshings and degradable solid wastes.

Key words:

› *Biological liquefaction of Fleshing, Environmental issues, Anaerobic Digester, Solid Waste from Tanneries, Bio-fertilizer & Bio-energy.*

012 Key technologies for tannery wastewater treatment

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ABSTRACT: Tannery wastewater is a complex mixture of organic substances derived from the hide and inorganic substances such as salts and chemicals, which are added during the beamhouse and tanyard processing. Sulphide and chrome bearing streams have to be segregated and are treated separately in a sulphide oxidation system and chrome precipitation plant. The segregated effluents are fine screened at 1 mm to remove coarse solids and mixed and aerated during the balancing stage to provide an uniform effluent for the following Primary treatment. Dissolved Air Flotation removes efficiently suspended solids of the wastewater achieving a clear effluent with < 50 mg/l Suspended Solids. The residual soluble COD and BOD is then treated biologically with a combination of anoxic and aerobic treatment to also allow removing nitrogen compounds such as ammonia, nitrate and Kjeldahl nitrogen. Biological denitrification/ nitrification in combination with membrane bioreactor technology achieves a high reduction of 92% COD and 99% BOD, with ammonia of less than 2 mg/l achieved in the effluent. The membrane bioreactor permeate is solids free and can be polished with Nanofiltration to allow for up to 75% high quality water recycling.

013 Analysis of Post-tanning Chemicals and Reduction of Pollution Load in Wastewater

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ABSTRACT: The transformation of the hide into finished leather requires sequential additions of chemicals in an aqueous medium, alternated with washing and mechanical operations. These chemicals are partially retained by the leather, and the fractions remaining in the process floats are discharged with the wastewater. Current literature has an extensive number of studies characterizing tannery effluents. However, few studies have evaluated how groups of chemicals applied to the leather impact the quality of wastewater generated in the process. Thus, this study aims to evaluate and reduce the impact of chemicals used in the post-tanning process on the main quality parameters of the wastewater. The assessment and reduction of the pollution load of leather chemicals were carried out using a formulation from a Brazilian tannery as a case study. Results showed that retanning agents (natural and synthetic tannins) were responsible for the highest inorganic pollution load in the wastewater, and the synthetic tannins were more toxic than the natural ones. The fatliquoring agents were responsible for the highest chemical oxygen demand load in the wastewater and were the chemical group that presented the highest cytotoxicity. The fixing agent and the dye contributed to the inorganic pollution load of the wastewater, and the nitrogen load of the wastewater was mainly related to the neutralizing retanner and the dye. The adjustment of the chemicals supply showed depletion in the pollution load of wastewater. The obtained leather showed quality within the required specifications of the tannery, and the formulation cost was reduced by 24%.

114 Bisphenol & Glutardialdehyde: Will old chemicals become a new issue in leather manufacture?

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ABSTRACT: Bisphenol A (BPA) has been introduced in chemical industry a century ago and since then has developed as a raw material for high performance plastics with an annual global production volume of several millions of tons. In the plastic no or only negligible residues of BPA can be detected, but there are a number of niche uses in the consumer sectorwhere BPA is applied as is. Apart from a substantial toxicological profile typical for phenolic compounds BPA has been demonstrated to be a low potency endocrine disruptor acting e. g. on the mammalian estrogen receptor. Those facts have resulted in a number of regulatory actions dealing with BPA. Among others, BPA is listed as an SVHC candidate substance and banned in Europe from the use in paper for thermoprinters and in plastic for bottles. A REACH restriction on consumer products including textile & leather has been announced. In the recent past those actions started to spill over to substances with a similar structure hat are used as raw materials (BPS) or present as residues (BPF) in synthetic tanning chemicals.

Glutardialdehyde (GTA)

Glutardialdehyde has established itself as the predominant reactive tanning agent for the preparation of wet white leather intermediates. Although the chemical itself is not without hazard, it can be made safer to handle by masking, and the final FOC leathers do not show free or hydrolysable aldehyde. Nevertheless, Glutardialdehyde was recently listed as an SVHC Candidate by European Chemicals Agency ECHA and is one of the focus substances in a planned restriction to eliminate sensitizers from textile and leather articles The presentation will give a condensed overview about the regulatory background and timelines, outline the challenges to the leather manufacturing industry and explain how the chemicals in the focus can be safely employed.

015 HYDROCARBONS RELEASE DURING THE BIODEGRADATION OF SOLID WASTE FROM TANNERIES FOR BIOGAS PRODUCTION

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ABSTRACT: Anaerobic digestion (AD) of organic waste is a method of producing renewable energy, i.e. biogas, with simultaneous waste treatment. Many biogas plants operate at sub-optimal loading rates to ensure a stable process at the expense of digester productivity. Previous researches focused on studying the feasibility of the AD of mixtures of shavings and sludge in co-digestion processes A gap remains in the initial stage of hydrolysis, where the organic load of the residues does not appear to be completely broken down into smaller hydrocarbons and carbohydrates to be bioavailable for microorganisms. The aim of this study was to evaluate the evolution of the hydrocarbon and carbohydrates release, the energy efficiency and the efficiency of the treatment of the waste of the AD of the solid waste of tanneries. The main results showed that the AD of the tannery solid waste can be separated into three phases: (i) a long lag phase of 20 days, where the microorganisms slowly adapt to the waste, due to its high recalcitrance, and ends with the beginning of the release of carbohydrates in the medium; (ii) a log phase with a low metabolic rate of 15 mL/day, due to the complexity of the waste, where much of the chromium present is bound or adsorbed to the shavings, not inhibiting the process with constant carbohydrate release and (iii) the final phase where all the shavings were metabolized and all the chromium dissolves in the reaction medium and the process stops.

016 A Salt and Chrome Free Leather Making Technology Based on multi-epoxy binary polymer

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ABSTRACT: In this work, a novel wet-white tanning approach based on aluminum sulfate and poly [poly (ethylene glycol) methyl ether acrylate-co-glycidyl methacrylate (PEGMA-co-GMA)] has been developed, aiming to avoid the environmental pollution caused by chromium and neutral salt, and improve the performances at the same time. The multi-epoxy binary polymer PPG (poly (PEGMA-co-GMA)) was synthesized by free radical copolymerization of poly (ethylene glycol) methyl ether acrylate (PEGMA) and glycidyl methacrylate (GMA). The hydrophilic PEGMA can endow PPG with good water solubility, and it can also cover the carboxyl group in collagen fibers, which is beneficial to the penetration of Al3+ in hides, as a result achieve uniform tanning. Fourier transform infrared spectroscopy (FT-IR) and 1H nuclear magnetic resonance (1H NMR) were applied to determine the chemical structure of PPG. The performances of leather prepared by PPG and aluminum sulfate combination tanning were studied by a set of characterizations. The results showed that the combination tanned leather possess favorable heat and moisture resistance (Ts > 83℃) and good mechanical properties. This is due to the reaction between active epoxy groups in PPG and the amino group in collagen fibers, which can not only improve the performances of leather, but also achieve salt-free pickling. Scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS) results showed that the collagen fibers were well dispersed and the tanning agent could penetrate evenly into the leather interior. In sum, these findings are beneficial to the development of clean tanning technology.

017 New frontiers of Advanced Diagnostics and Non-Destructive Testing for quality control in the tanning industry

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ABSTRACT: Leather is one of the most representative materials of the leading sectors of world markets, such as fashion and luxury, interior design, automotive, thanks to its excellent intrinsic properties, in terms of technical performance and sensorial features, able to guarantee its high quality. Although material of natural origin, leather undergoes numerous substantial transformations during the production process, which, together with its anisotropy and with the increasing use of a wide range of novel sustainable/chromium-free tanning systems, sometimes makes some defects unpredictable. This work describes how some specific instrumental detection techniques are able to provide information regarding the possible c uses of defects, also revealing the specific phase of the tanning process potentially responsible for the problem; particularly, the study emphasizes the effectiveness of techniques such as ATR-IR (Attenuated Total Reflection Infrared) Spectroscopy, Scanning Electron Microscope (SEM)-X-Ray Probe, Gas Chromatography-Mass Spectrometry (GC-MS), DSC/TGA (Differential Scanning Calorimetry/ Thermogravimetric Analysis) in identifying the causes of stains, chromatic or morphological alterations, cracks and detachment of the finishing. Furthermore, in order to guarantee increasingly predictive and non-invasive approaches, Non-Destructive Testing (NDT) systems have been considered for their use in the quality control of tanning productions, with particular reference to the use of optical Interferometric Techniques, laser based, such as the Electronic Speckle Pattern Interferometry (ESPI), and of Computer Vision techniques, based on the acquisition and processing of signals and images at different wavelengths, from visible to infrared. The possibility of using robotic systems specifically designed for the manipulation and scanning of online products, through non-destructive and automated approaches, was also evaluated thanks to the increasingly widespread use of deep learning approaches, where these technological developments will certainly benefit the production chain to achieve ever higher standards of quality of leather products.

018 CARBON FOOTPRINT ITALY: A COMMUNICATION TOOL SUPPORTING ENVIRONMENTAL AND CLIMATE EFFORTS

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ABSTRACT: This work reviews the opportunities to make the communication of carbon footprint of products (CFP) more effective, starting from the experiences of Carbon Footprint Italy (CFI) and Carbon Footprint international. In view of the implementation of the ambitious policies set globally, requiring a quick and irreversible decarbonization of all the sectors, it is crucial to guarantee that transparent, reliable and effective information is provided to the public. The ISO 14067 standard is the internationally recognized tool for the CFP quantification. Nowadays, it is broadly adopted by companies aiming at providing reliable results. The analysis is focused on the CFI initiative. First, it values credibility, only allowing the participation to products/organizations owning a verification statement issued by an accredited independent third-party. It promotes transparency, making all the information publicly available on a dedicated webpage for each registered product, easily accessible through a QR code that can be printed on the product itself. Finally, it valorizes reliability by using the blockchain technology, that stores the data in an unmodifiable way, allowing for solid and credible performances tracking over time. The review also covers the global scenario of existing initiatives, gathered in the international network created to boost the global recognition of carbon footprint (https://carbonfootprintinternational.com/). Finally, the analysis assesses the opportunities for collaboration between different actors of the value chain, as crucial to encourage virtuous cycles. The example of the tannery and leather supply chain is reported, with involved realities ranging from raw materials suppliers, tanneries and final product users.

019 Is leather still the 'material of choice' for footwear?

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ABSTRACT: Historically leather has been the first choice for use as both an upper and soling material for footwear, but in recent years leather's place as the 'material of choice' has been challenged by many other materials – some of them regarded as sustainable innovations. SATRA will provide a panel of technical experts to debate the role of leather as a sustainable material in the footwear industry and will consider aspects such as 'fitness for purpose', longevity, durability, technical performance and innovations including thermal insulation, foot comfort etc. There will be an opportunity for delegates to participate and pose questions to the panel.

020 APPLICATION OF KINETICS MODELS IN LEATHER PROCESSING

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ABSTRACT: Kinetics are present in almost all industrial processes. Its study is the key to clarify the behavior of many chemical systems. Understanding how a reaction occurs, elementary steps, reaction pathways and kinetic mechanisms, the processes can be improved. In leather processing, the study of kinetics provides important information about the necessary operating time in beamhouse, tanning, dyeing and fatliquoring, so that energy and resources are saved. Through the experimental kinetic study a model can be fitted to the data so that it numerically reproduces the experimental measurements of the process in a satisfactory way. The model fit is important because it allows the optimization of the process without the need for more experiments to be done. In literature, (i) phenomenological kinetic models are found, obtained through the laws of physics and chemistry, as well as the laws of conservation of mass, energy and movement and (ii) empirical models, based on experimental data obtained in the process, which are generally correlated by statistical and mathematical methods, such as regressions. For leather processing, few works use kinetic models, even though a wide variety of studies that perform kinetic experiments are found. The aim of this work was to evaluate which kinetic models are used in leather process, as well as to identify whether the hypotheses made in these models correspond to what occurred experimentally. The most used models are: Pseudo-first order, Pseudo-second order, Elovich, Weber-Morris, Cegarra-Puente and modified Cegarra-Puente. They were applied in the stages of dehairing, tanning and dyeing.

021 Melamine Ethoxylates: Novel Formaldehyde free Resin Re-tanning Agents

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ABSTRACT: Melamine formaldehyde condensates or resin re-tanning agents are still used as common products in the leather industry. They give rise to homogeneous filling, are easily and widely applicable, but generally contribute to free formaldehyde measurable in emission of extraction methods from leather. Many projects to resolve this issue have been carried out. In this presentation the weakness of the resin re-tanning will be explained from a chemical view and insights into the chemistry and synthesis of new and innovative melamine ethoxylates as a potential substitute will be given. Emphasis will be given sustainable aspects within the project. Besides replacing formaldehyde it proved to be possible to incorporate renewable components into the synthesis. Another green aspect is the delivery of the potential product as a liquid versus most resin re-tanning agents being placed into the market as spray dried powders consuming significant amounts of energy. Melamine ethoxylates are stable and well applicable on leather. Results on leathers will be given in comparison to a classical resin re-tanning agent. An insight into the scope of application will be presented, showing that melamine ethoxylates can be considered a formaldehyde free replacement for resin re-tanning agents.

022 Phenolic monomers in aromatic syntans and their influence on leather: (Pending) Restricted compounds

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ABSTRACT: Aromatic syntans are widely used in the (re)tanning of leathers. Phenolic monomers such as phenol, phenolsulfonic acid, bisphenol S and bisphenol F are common in the aromatic syntans in small quantities. These compounds are unreacted molecules that are either starting material or intermediate molecules during the processes. Due to the toxic nature of these compounds, both the regulatory authorities and the leather industry are displaying an increasing interest in the residual phenolic monomers. There are various regulatory proposals in discussion on the amount of phenolic monomers (e.g., a restriction proposal on Bisphenols is pending at REACH.) When approved, it will lead to a combined content restriction of bisphenols in leather articles of 200mg/kg (or 0.02% or 200 ppm). Similarly, bisphenol S is proposed for listing on California Proposition 65. In this context, the authors attempted to study on different phenolic monomers present in aromatic syntans and their effects on leathers. The effect of monomers on the haptics, light fastness, heat yellowing, and residual floats was studied. The study has discovered the small increase at tightness and hardness in leathers with the increase of monomers at low quantities ~2 wt%, while at >10 wt% monomers in aromatic syntans the leathers have become emptier. Further the research has revealed that monomers have the following order of influence on the light fastness Phenol>Bisphenol S =Bisphenol F>phenolsulfonic acid. E.g., an aromatic syntan with free phenol, <50 ppm has GS of 4,0 or above was reduced to 2,0 when free phenol was increased to 4.000 ppm in the aromatic syntan. There is no significant effect of phenolic monomers visible on the heat yellowing. Phenolic monomers have roughly 80% uptake, and leaving the rest into the waste waters. The research study consists of 3 different parts **(i)** Amount of monomers: First part discusses the amount of phenolic monomers in different aromatic syntans across the market and their leathers. **(ii)** Model study: A research study has been conducted to determine the effect of each specific monomer in a specific syntan on the leather. Model syntan samples were prepared from a specific syntan with different loadings of each monomer in order to determine the effect of each monomer. **(iii)** Effects of monomers: In this part an attempt has been made to correlate the combined effects in different syntans across the market to the amount of monomers present in them. Formaldehyde emission data of the studied samples were included to give a total overview on the syntans.

023 A novel preparation of formaldehyde free melamine resin and its retanning behaviors investigation

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ABSTRACT Melamine resin (MR) retanning agent was widely used in leather industry, but often suffered the problem of formaldehyde release. Although numerous efforts have been devoted to solving the formaldehyde issue by using alternative aldehyde materials, it often presents a new challenge of poor storage ability due to the low aldehyde activity. Herein, a new formaldehyde-free melamine resin MGE was prepared in this paper through a novel synthesis strategy. Melamine was firstly bonded with lysine to improve its amphoteric and water solubility, and the epoxy compound was further used as a cross-linker to prepare melamine resin. Comprehensive structural and performance characterization of MGE confirmed the presence of amphoteric groups in its structure. Its isoelectric point was determined to be 7.55, significantly higher than the other two commercial MR which are 2.94 and 4.69, respectively. Moreover, MGE showed high storage stability of more than six months. The physical and mechanical properties of MGE retanned leather, along with its reactivity to anionic fatliquor were also fully investigated. Owing to the ionic bonds and hydrogen bonds between MGE and collagen fibers, MGE-treated leather showed improved physical and mechanical properties. The absorption of MGE was 77.08% and the thickening rate was increased by 19.23%. This study provided a new strategy to synthesis formaldehyde-free melamine resin with high stability.

024 Development of a smart aluminum (III)-loaded nanoparticles with pH-controllable sequential penetrate behavior for chrome-free tanning process

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ABSTRACT: In this work, a nano-sized smart aluminum (III)-loaded nanoparticle (Al-NPs) with acidic pH-sensitivity was fabricated and applied as a chrome-free tanning agents. The nanoparticles were prepared via in-situ Al(OH)3 mineralization by using a hydrophilic terpolymer as template. The prepared Al-NPs is stable under neutral and weakly acidic conditions (pH≥5.0), and possess higher penetration efficiency into collagen fibers compared with conventional aluminum tanning agents. Besides, it was only allowed to penetrate into the micrometer-scale intervals of collagen fibers in the hierarchical structure, due to the limitation of their nano-size. By comparison, the free diffusion of Al3+ salts could easily form penetration balance in the hierarchical collagen and cause a crosslinking efficiency of less than 70%. Moreover, the pH-sensitive Al-NPs could be rapidly dissolved at pH 3.0 and further release Al3+ ions into the nano-scale interspace between collagen fibrils, which would react with carboxyl groups of collagen molecules at pH 4.0 to form strong coordination bonds and lead to efficient cross-linking of up to 95%. The shrink temperature of Al-NPs tanned leather can reach up to 90.5°C due to the increasing crosslinking rate of Al3+. Besides, the tear strength and tensile strength can reach up to 28.5 N·mm-1 and 14.5 MPa respectively, which were obviously increased than the leather tanned by traditional aluminum tanning agents. This study provides new insights for the development of chrome free tanning agent and it also has a positive significance for the application of nanomaterials in tanning process.

025 Extraction and Purification of Collagen from Tannery Fleshing Waste: A way forward for Sustainable Leather Manufacture

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ABSTRACT: The leather industry produces a massive amount of solid wastes at different stages of operations. Among these, fleshing waste constitutes a significant amount and poses a big disposal challenge due to the presence of lime and sulphide. Therefore, it is essential to find a way to deal with fleshing wastes without escalating costs. We aimed to exploit the high collagen content in fleshing waste. Here, we have extracted highly pure collagen from limed fleshing by a simple four-step process involving de-liming, solubilization, precipitation and dialysis. The collagen content in fleshing wastes was found to be 12.73% (w/w). The extracted collagen was further subjected to a battery of analytical tests to analyze its purity and quality. Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis (SDS-PAGE) and Elemental analysis (CHNS) revealed that the extracted collagen was highly pure with negligible protein and non-protein contaminants. Further investigation by Fourier Transform Infrared Spectroscopy (FTIR) and Circular Dichroism (CD) spectroscopy confirmed that the extracted collagen was in its native triple helical state. The extraction efficiency of this process was found to be around 85%. Therefore, we have been able to prove that fleshing wastes may be used as a source for highly pure collagen which can be used for high-end applications like biomaterials, which can be an additional revenue stream.

Key words:

› *Collagen, Limed fleshing, Leather, Solid waste, Waste Management*

026 PREPARATION OF SHOE SOLING MATERIAL USING LEATHER AND TEXTILE WASTE

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ABSTRACT: Recycling or reusing waste or by-product is usually ignored when it comes to production processes. The leather processing industry produces large amounts of solid organic wastes in the form of un-tanned (trimmings, fleshing, splits) and tanned (trimmings, splits, and shavings) waste from raw hides and skins, semi-processed leather, as well as sludge as a result of wastewater treatment. Suppose these solid wastes are not properly treated and disposed of. In that case, they can cause environmental damage to soil and groundwater and emissions of odor and poisonous greenhouse gases into the atmosphere. The textile industry is the second biggest polluting industry. The average life span of a garment is roughly three years, and so, textiles generate a huge amount of waste. Five percent of all global landfills are being taken up by dumped textile waste. The fabric waste from carding, combing, drawing, and spinning is called soft waste. Wastes produced after spinning and twisting and in the process of weaving and knitting are called hard waste. It is not possible to avoid wastage during production or usage of textiles. Besides, sensible analysis of a product's shopping behavior and life cycle among the consumers is essential. The huge q

027 Pathway to a sustainable leather industry

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ABSTRACT: The topic of sustainability in the leather industry is often misunderstood, misaligned and mismanaged. Given the inherently sustainable properties of leather, as an industry it has never been more important than now to bring all sectors together for the common objective of achieving a sustainable future.

The work of the Sustainable Leather Foundation is founded on the principle of People–Planet–Profit and the paper will demonstrate how by applying those principles within a structured mechanism, industry can not only protect the environment but also improve social impact and provide a tangible return on investment. Key areas of the paper will consider:

- Definitions and principles of sustain ability specific to the leather industry
- Why industry needs to look outwards, cross-sectorally, for strength of purpose
- What roadmap industry can adopt to gain better understanding of risk v mitigation
- The importance of innovation within cur rent technology to achieve reduced impacts

028 Green chrome-free tanning agent based on epoxy-modified dialdehyde starch towards sustainable leather making

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ABSTRACT: Deleterious effects of Cr6+ on humans and the environment have attracted widespread attention worldwide, compelling the leather industry to urgently search for an eco-friendly tanning agent that can replace chromium. In this study, ethylene glycol glycidyl ether (EGDE) was grafted onto dialdehyde corn starch (DCST) with an oxidation degree of 91% and the terminal epoxy group was retained to synthesize a biomass-based chrome-free tanning agent (DCST-EGDE). Gel permeation chromatography (GPC) results revealed that the weight average molecular weight (Mw) of DCST-EGDE is reduced to 1143 compared with that of raw corn starch (CST), which can satisfy the requirements for a tanning agent used for making leather. Scanning electron microscopy (SEM), X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, and X-ray photoelectron spectroscopy (XPS) revealed that EGDE is successfully grafted onto the C6-OH of DCST and that the terminal epoxy group is retained. The epoxy value of DCST-EGDE reached 0.284 mol/100g. The shrinkage temperature (Ts, 85.2°C), mechanical properties, and whiteness of the leather tanned by DCST-EGDE were considerably improved in comparison with those of the leather tanned by DCST. Compared with leather tanned by the most widely used tanning agents of F-90 and TWS on the market, its comprehensive performance also exhibited more advantages. Therefore, DCST-EGDE is expected to become a new biomass-based ecological chrome-free tanning agent to replace chromium.

Key words:

› *biomass, dialdehyde starch, chrome-free tanning agent*

029 Leather Product Design Canvas & Leather Design-Guidelines for Sustainable Development – The Role of Design as a Driver for Sustainable Leather Goods in the 21st Century

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ABSTRACT: Leather as an ancient material features characteristics and material properties that in many cases relate to sustainability by default (e.g. longevity, reparability and aesthetically pleasing aging). At the same time, highly complex and opaque leather supply chains and increasing functional and aesthetic demands are in contrast with this leading to problematic conditions regarding for instance the leather chemistry. In line with regulatory developments (e.g. the EU Green Deal and related policies) and rising consumer awareness, many companies in the leather supply chains strive to use "more sustainable chemistry" and to produce "more sustainable" leather goods. Starting in the early phase of product development design decisions (including sourcing and LCA) pose big opportunities in this competitive market. However, because of the technical and structural complexities it is hardly possible to set up a list of design aspects that lead to more sustainable leather goods by default. The herewith presented concept of "leather design guidelines for sustainable development" aims at supporting the product development process of leather goods in favour of sustainable development by offering methods, case studies and paradigms that help designers, product managers and other parties involved in this process. Based on the results of a transdisciplinary research project (including a scenario process) these guidelines are being developed together with representatives from organisations along the leather value chains, as well as NGOs, as part of the project "Systeminnovation: Nachhaltige Entwicklung (s:ne)" at the Darmstadt UAS. This project is directly linked to three other subprojects on traceability, regulatory frameworks and chemical and process innovations for a more sustainable leather chemistry. This conference contribution outlines the work done so far in drafting these guidelines. An overarching framework for the guidelines – the leather product design canvas – will be presented that draws links between general design process aspects and approaches for sustainable development specifically focusing on leather goods. From this perspective, innovative systemic solutions as well as business models (i.e. product-as-a-service offerings) can be developed that reach beyond the current approaches of leather product design. At a later phase of this project, the guidelines will be applied to one or more products as pilot studies to evaluate them regarding usability and effectiveness.

030 MOFs-Enabled Polyacrylate Based Nanocomposite as Flame Retardant Leather Finishes

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ABSTRACT: The exsist of lots of grease and the introduction of fatliquor into leather matrix will raise a serious security issue due to its inflammability. Tunable functionalities and convenient synthesis boost metal-organic frameworks materials (MOFs) attraction in the realm of new flame retardants. Herein, a series of MOFs was introduced into polyacrylate emulsion by physical blending method to prepare polyacrylate/MOFs nanocomposite emulsion. Then, the obtained nanocomposite emulsion was applied in leather finishing to enable leather with flame retardance. The structure and morphology of MOFs were characterized by XRD and SEM, and the flame retardance of finished leather was tested by vertical combustion (UL-94), limiting oxygen index (LOI) and cone calorimeter. The results exhibited that usage of 1wt% MOFs could reduce the burning rate of finished leather. Meanwhile, controlling its size within 500 nm~1 μm made the burning time of open flame shortened by 36%. Additionally, integrating with MOFs not only endowed the flame retardance of polyacrylate finished leather, but also enhanced its mechanical performance.

031 Study on 3D layered double hydroxide@montmorillonite for improving flame retardant properties of leather

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ABSTRACT: During the processing of leather, fatliquoring agent is one of the commonly used leather chemicals that can give leather soft, plump and other feel, but the neutral oil in fatliquoring agent is flammable oil, which will lead to flammable leather. How to solve the flammability problem of leather products to meet the market demand for flame-retardant leather is one of the key research directions in the development of functional leather. Montmorillonite(MMT) is a layered material with a negative charge and has excellent flame-retardant properties. Layered double hydroxide(LDH) is also a layered material with a positive charge and has flame-retardant and smoke-suppressing properties. In this paper, layered double hydroxide @ montmorillonite(LDH@MMT) was prepared using MMT and LDH with electrostatic force by the hydrothermal method. Combined with XRD and SEM characterization, the flowery LDH@MMT was prepared. Then LDH@MMT was introduced into pepper seed oil to prepare modified zanthoxylum bungeanum seed oil(MZBMSO) leather fatliquoring agent, which was used in leather fatliquoring process. Compared with the leather treated with MZBMSO, the after flame time of the leather treated with LDH@MMT/MZBMSO was reduced from 87 s to 43 s, the limiting oxygen index was increased from 26.3% to 28.3%, the heat release rate decreased by 43.6%, the total heat release decreased by 74.0%, and the total smoke production decreased by 57.3%, which indicated that it improved the safety of leather.

032 A antibacterial strategy on chrome-free tanned leather: based on β-cyclodextrin aldehyde derivatives and small molecule antimicrobial agent

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ABSTRACT Chrome tanning has dominated in leather production up to now, while facing a significant challenge in terms of chromium. Therefore, the chrome-free tanning process become an inevitable choice. However, chrome-free tanned leather (CTL) is poor in antibacterial property, which limits its practical application in leather production. In this work, a new environment-friendly antibacterial strategy based β-cyclodextrin (β-CD) aldehyde derivatives and ciprofloxacin hydrochloride (CH) as a small molecule model antibacterial agent was developed to address this issue along with improving the comprehensive performances of leather. The structure and properties of obtained leather was characterized by Fourier transform infrared spectroscopy, scanning electron microscopy, differential scanning calorimetry, thermogravimetric and its antibacterial effect against E. coli and S. aureus was investigated. The results showed that compared with CTL without β-CD modification and CH treatment, the Ts, Td and Tp of the leather with this method possessed increased 5.7 °C, 4.9 °C and 6.9 °C, respectively. After treated by CH with 90 days of storage, the antibacterial rates against E. coli and S. aureus still reached 99.8% and 97.4%, respectively, which were 29.9% and 34.4% higher than those without β-CD treatment. It, that antibacterial agent is included in the cavity of β-CD on CTL, will improve the poor antibacterial durability due to the release of the small molecule antimicrobial agent. These findings therefore indicated that a new antibacterial method on CTL with β-cyclodextrin aldehyde derivatives and ciprofloxacin hydrochloride has potential practical application prospect in leather production.

033 Vegetable tannins uses and antioxidant property

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ABSTRACT: Vegetable tannins are phenolic compounds of great economic and ecological interest. They are found in roots, wood, bark, leaves, fruits, seeds and sap of different plant species. The tannin composition and their chemical characteristics that allow a series of reactions to modify their chemical structure give possibilities for a wide range of uses for them. Historic used as tanning agents, recently, the interest for different applications of tannins has grown and several studies evaluated either they can be successfully used or not as flocculants, dispersants, antioxidants, biocides, etc. The antioxidant properties of tannins are well known and they could be used with this purpose in foods, beverages, fuels, lipids systems, polymers, etc, replacing synthetic and other less available plant extracts. However, their antioxidant properties are scarcely studied. The antioxidant property of acacia (Acacia mearnsii), chestnut (Castanea sativa) and quebracho (Schinopsis lorentzii) of commercial tannins extracts were tested. The commercial tannins were characterized by TG/DTG analyses, Folin-Ciocalteau method for the determination of total phenolic content (TPC), against DPPH (1,1-diphenyl-2-picryl-hydracyl) radical for scavenging capacity and ash content. The results showed that plant tannins reach a maximum of 90% DPPH inhibition at a concentration of 12.5 mg L-1.

034 Green antimicrobial bio-based nanocomposite hydrogel for leather finishes

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ABSTRACT: With the increasing pressure of global environmental protection, green biodegradable leather finishing materials have become an inevitable trend of development. In order to overcome the defects of traditional casein films, such as hard, brittle and poor resistant to microorganisms, and to endow films with expected functionality, thus to improve the added-value of finished leather product,in this study, using casein as the matrix, triethanolamine as the solvent, ZnO NPs as the crosslinking agent and antibacterial agent, the green antibacterialcasein- based nanocomposite hydrogel materials were prepared by "semi-dissolution acidification sol-gel transition method".The morphology and structure of as-obtainedhy drogels were characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). The swelling properties, salt resistance, mechanical properties (including tensile properties, gel strength) and antibacterial properties were investigated. The results showed that nanocomposite hydrogels with three-dimensional network structure were successfully prepared,which exhibited good antibacterial effect against E.colisince the antibacterial rates against E.coli was 70%. The mechanical tests demonstrated that when the content of CA was 1.75 g, the amount of ZnO NPs was 3%, and the gelation time was 10 h, the tensile properties of the nanocomposite hydrogel reached 1655 KPa whist the gel strength reached 12301.4 g. AThis fabricated hydrogel can be verified that could endowleather and its products with excellent moisture retention, antibacterial and mechanical properties. This research has a positive guiding effect for the development of intelligent leather-based flexible sensing materials.

035 STUDIES ON OPTIMIZATION OF AMYLASE EXTRACTION USING FABRICATED EXTRACTOR COLUMN FOR FIBER OPENING

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ABSTRACT: The work was concerned with studies to maximize and optimize the extraction process using fabricated extractor column from bacterial culture under solid state fermentation (SSF) using agro industrial residue for fiber opening. Various process parameters are optimized for maximum extraction of enzyme. These extraction parameters were optimization of pH, temperature, particle size using wheat bran as a substrate, buffer flow rate, packing bed volume and investigate the effect of single and dual column system on effective enzymatic extraction process. Comparisons were made between the conventional and column type of extraction methods. Moreover, continuous system of column extraction process was correlated with batch system and conventional method of enzyme extraction process based on their total yield. The finding of the study suggests that, the optimum condition for maximum amylase extraction with medium sized wheat bran at pH of 7.1 and temperature of 30 0C yields 1332.31 U/gds and 2374.51 U/gds in solid state fermentation media respectively. This was verified in quantitative DNS assay method. Continuous column extraction process with optimum flow rate and bed volume provides a maximum total yield of 75% higher as compared with other type of extraction mechanisms. In order to check the benefits of α-amylase, the crude enzyme extract was partially purified by micro and ultra-filtration process for applying it for leather application. In an attempt to reduce the pollution load from pre tanning operation, a concentrated amylase is applied on goat skin. Hence, studying the effect of fiber opening between enzymatic and chemical process by various tests were carried out. The finding revealed that the extracted enzyme releases higher amount of proteoglycans after enzyme treatment. The effect of fiber splitting on the strength properties related morphological changes of the crust leather samples were thoroughly investigated. scanning electron microscope analysis was also carried out. According to the result the inexpensive enzyme produced in this study shows a significant release of inter fibrillary materials and adequate strength property of crust leather.

036 STUDY OF THE DETERMINANTS OF TECHNOLOGY ADOPTION BY THE SMES IN LEATHER PRODUCTS MANUFACTURING S IN KENYA

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ABSTRACT: The Kenyan leather sector has a huge potential of transforming the nation. It has been ear marked for the economic pillar for vision 2030. If full potential is to be realized, a number of challenges must be addressed, the key thing being technology adoption. Technology adoption has a major impact on the quality and quantity of goods manufactured. This research explores the level of technology adoption by the SMEs in the leather goods manufacturing firms in Kenya and there after determine the major determinants of technology adoption. Eighty one (81) SMEs were sampled using a simple random sampling technique. A Structured questionnaire was designed to facilitate the acquisition of relevant data. Descriptive statistics was used. From the findings none of the firms had adopted the soft technology while only 6.0+/-0.5% adopted the hard technologies. Lack of sufficient capital (finance) was cited as the main reason for the low rate of technology adoption. Other factors include insufficient technical skills, commitment failures by top management and competition. To overcome the above challenges, it is recommended that financial supports and tax relief be extended and capacity building initiative be extended to SMEs in leather

037 An investigation on usability of 3D visualization and simulation programs in leather apparel

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ABSTRACT: Three-dimensional (3D) visualization and simulation programs cannot be used in leather apparel companies prevalently due to the lack of leather material information in the databases. In this study, the properties of different types of leather and fabrics are determined with certain standards and alternatively with FAST (Fabric Assurance by Simple Testing) system, interpreted and defined in the database of Vidya 3D program. The two-dimensional (2D) garment patterns prepared in the Assyst CAD program were transferred to the 3D program, and dress simulations were performed on the virtual mannequin by using the newly defined materials. The sewn dresses and simulations were evaluated by a jury considering similarity success. It has been found that Vidya 3D program can simulate model and material behaviors realistically by using the data obtained from the FAST system, however, it does not demonstrate the drape parameter precisely, and the software should be improved for this direction.

138 LEATHER SMELL IMPACT ON CHINESE AUTOMOTIVE MARKET

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ABSTRACT: For most western countries, that rich, sweet, musky smell of new-car leather is a big part of its appeal. Not so for the Chinese. They can't stand it. After decades of rapid expansion, from 12 million car sales (2010) to 24 million in (2017), Chinese automotive market become the biggest market in the world. In other words, one car of each four is sold and produced in China nowadays. One third of the Chinese car market share belongs to the Premium segment which leather material is the most preferred distinctive luxury option. But in 2010 car manufacturers started having an increasing customer complaint that the car interior smell didn't appeal to the Chinese customers. Over the last four years complaints decreased but still the Nr. 1 car interior problem for all car manufacturers. For these reason auto interior odours and volatile organic compounds emissions are coming under more scrutiny in China. While US and Germany allow each automaker to use its own standards, China has a national standard for VOC that is more stringent than many other countries. One reason why VOC testing has not been as much as priority in US is that there are more standards in place already for base materials such formaldehyde, among others. At the same time odor tests are not a scientific process. Tests are conducted by people with trained noses, but two people can smell differently and frequently it is a matter of preference. There are preferences across regions globally. Often a feeling or emotion is attached to a certain smell. Odor testing is a super subjective test, because is done by the human nose. What is pleasant for me is different for others and this is more accentuated across regions globally. Getting rid of an odor can be difficult but understanding the chemistries of these volatile compounds is possible to minimize the risk of unpleasant smells in car interiors. Over this presentation we will discuss the root cause, on the what, and why smell in China is a problem not solved yet. To answer these questions, we need to understand what our sense of smell means, how leather smell is tested, and which volatiles compounds comes from leather.

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Poster Presentations

039 A green clean chrome-free tanning system based on POSS-COONa and zirconium

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ABSTRACT: In this work, a green and clean tanning technology based on the polyhedral oligomeric silsesquioxane sodium carboxylate(POSS-COONa) and zirconium sulfate was studied to relieve the environmental pressure and resource strain caused by chrome tanning. Firstly, amino sesquisiloxane was prepared from γ-aminopropyl triethoxy silane by hydrolysis and condensation method, and then was substituted with sodium chloroacetate to form POSS-COONa. The POSS-COONa had crystallinity and maintained cube structure by X-ray Diffraction and Transmission Electron Microscopy. The POSS-COONa and zirconium sulfate were applied in chrome-free tanning process of goat skin. Compared with zirconium sulfate tanned leather, the shrinkage temperature of combined tanned leather increased from 83.5 ℃ to 90.5 ℃, the thickening rate increased from 88% to 118.3%, and the softness increased from 5.9mm to 6.5mm. The Scanning Electron Microscopy and Energy Dispersive Spectroscopy showed that combined tanned leather fibers were braided loosely, and POSS-COONa and zirconium sulfate could be evenly dispersed among the collagen fibers. The tensile strength, tear strength and elongation at break of the combined tanned leather with POSS-COONa and zirconium sulfate were 26.4 N/mm2, 96.3 N/mm and 105.5%, which were similar to those of the tanned leather with zirconium sulfate. Based on the above results, POSS-COONa and zirconium sulfate tanning has a promising future in clean production.

040 An integrated cleaner technology for minimization of pollution using enzymes and auxiliaries in leat

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ABSTRACT: The conventional beamhouse of leather manufacturing invariably results in pollution of ammonia-nitrogen (NH3-N), chloride and chromium in wastewater, which is seriously restricted the sustainable development of the leather industry. In order to minimize the emissions of harmful chemicals, an integrated non-ammonia bating, salt-free pickling and high exhaustion chrome-tanning technology was designed and optimized. The results indicated that, being superior to the conventional bating-chrome tanning process, the novel technology almost eliminates the NH3-N and chloride pollution by using salt-free pickling auxiliaries and acidic proteases. In the novel technology, the total Cr utilization ratio was increased to 94.9% from 80.4%, the residual Cr concentration in the tanning liquor dropped to 294 mg/l from 1134 mg/l. Additionally, total residual contents of total nitrogen (TN), total organic carbon (TOC) and chemical oxygen demand (CODCr) were reduced by 75.7%, 37.1% and 45.2%, respectively. The scale-up experiments were conducted in furniture and shoe upper leather factories verified that the novel method was acceptable in the aspects of physical and organoleptic properties of the resultant leather. It is anticipated that the effluent liquors containing very small amounts of NH3-N, chloride and chromium can be more easily disposed. The established novel technology can be evolved as an environment-friendly technology and matches the integral requirements of the modern sustainable leather industry.

041 Application of a novel vegetable tannin in leather processing extracted from Xylocarpus granatum plant bark

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ABSTRACT: Tanning is an essential process for the production of leather using mineral and vegetable tanning agents. Tanning stabilizes proteins of raw hides/skins and determines the ultimate quality of the finished leather. The intense pressure of the chrome-containing solid and liquid wastes of tanneries urges the leather industries to seek alternative tanning agents due to their environmental restrictions. In this study, an attempt was taken to apply novel vegetable tanning agents in leather processing extracted from Xylocarpus granatum bark. A comparative study was conducted with conventional vegetable-tanned leather tanned with mimosa and quebracho tannin. The leather tanned by Xylocarpus granatum bark extract showed the shrinkage temperature (Ts) 86.34±1.52 °C, and the physicomechanical properties such as tensile strength 298 kg/cm2, tear strength 39 kg/cm, grain cracking load 29.33 kg, distention at grain crack 14.50 mm, ball bursting load 40.33 kg, and distention at ball bursting 16.58 mm that was quite comparable and superior to the conventional vegetable-tanned leather and the standard recommended by United Nations Industrial Development Organization (UNIDO). The fibre structure of the experimental leather was observed through Field Emission Scanning Electron Microscopy (FE-SEM) and found tighter than that of conventional vegetable-tanned leather. Thus, Xylocarpus granatum bark extract can be a good alternative to mimosa or quebracho as a prospective vegetable tanning agent in leather processing.

042 Circular technologies for leather processing

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Circular technologies for leather processing

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ABSTRACT: The challenge of the present time is production without waste generation through the circular economy concept. The leather industry capitalizes on a by-product of the meat industry and generates other valuable by-products which can represent around 80% of raw material. Collagen and keratin are the main proteins which can be recovered and functionalized for different applications. The extraction of collagen and keratin from protein by-products and their recirculation still represents a challenge for quality leather processing and management of waste generated by leather industry. The present research shows the potential of these recovered proteins to be reintroduced in bovine or sheepskin processing technologies with effect on ammonium and chromium salts reduction or elimination. In view of designing new deliming products, leather shavings and coarse wool were hydrolysed by alkaline and alkaline-enzymatic hydrolyses and conditioned at pH value for deliming of bovine pelts. Combinations of protein hydrolysate and maleic copolymers enabled the reduction of ammonium salts by 85%, with beneficial effect on improved chromium exhaustion in tanning process by 20%, as compared to classical process based on ammonium salts. Basic chromium sulphate in sheepskin tanning was completely replaced by using a new composite of collagen hydrolysate, whey and mimosa or tara extracts. Pre-tanned sheepskins presented 680C hydrothermal stability and good ability for interaction with anionic retanning auxiliaries. The organic pre-tanned and retanned sheepskin leathers were evaluated and showed standard characteristics in terms of physical-chemical and physical-mechanical properties.

043 Comprehensive evaluation of the biodegradability of leather tanned by different tanning methods

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ABSTRACT: Leather is a type of sustainable and high value-added material that is derived from animal hides/skins, the by-product of the meat industry. Biodegradability is one of the most essential characteristics of leather. Herein, the biodegradability of a variety of leather samples, including chrome-tanned leather, non-chrome metal tanned leather, aliphatic aldehyde tanned leather, dialdehyde polysaccharide tanned leather, and untanned depickled hide (control) were determined using three approaches. Soil burial test was conducted for 12 months to evaluate the biodegradability of leather in a natural environment. Changes in appearance, mass and thermal stability of leather samples were recorded, and changes in element contents and microorganism content of soil were analyzed. Three chrome-free tanned leather samples exhibited higher extents of biodegradation than that of chrome tanned one, and aldehyde tanned leather showed better biodegradability than metal tanned leather. The biodegradability showed significantly negative correlation with the thermal stability of leather. Moreover, the aerobic biodegradability of leather in an aqueous medium using activated sludge was also determined. The oxygen demand and the evolved CO2 were measured, respectively, using two different approaches. The test time can be shortened to no more than 30 days. The results of biodegradability of leather samples were in accordance with those from soil burial test, further demonstrating that chrome-free tanned leather should be more degradable than conventional chrome tanned leather. In addition, synthetic polymer materials such as PU were more difficult to degrade than leather, indicating the superior sustainability of natural leather.

044 EVALUATION OF THE EFFICIENCY OF AMIDO BLACK 10B AZO DYE DEGRADATION IN AQUEOUS SOLUTION BY OZONATION

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ABSTRACT: The need for adaptation of the leather industry to the current environmental legislation imposes increasing costs of systems of treatment projects of generated effluents in tannery industries. Thus, companies need to adapt to the requirements and adjust their budgets to reduce environmental impact. Tanneries have a great responsibility in the depletion of water bodies. These industries generate effluents with high organic load, color and toxicity. Thus, they need to adopt systems that make the tannery processes more efficient, using new technologies, such as Advanced Oxidative Processes (AOPs). Ozone (O3) is a powerful oxidant, with an outstanding oxidation potential. The aim of this work was to develop, through bench scale ozonation, the reduction of Amido Black 10B dye present in tannery effluents. The equipment used was formed by an ozone generator with a batch reactor system, specific for the formation of ozone. To evaluate the effective ozonation and mineralization of the dye in aqueous solution (100mg/L), the following parameters were analyzed: dye removal by UV spectrometry; total organic carbon reduction (TOC); sulfates and nitrates generation by ion chromatograph (IC); and changes in indicative parameters of the carbohydrate metabolism – glucose and lactate (ecotoxicity) were determined. In this context, the system studied proved to be an effective alternative for the treatment of effluents containing dyes derived from the tannery industry, achieving a maximum dye removal of 100% in approximately ten minutes of reaction.

045 High exhaustion chrome tanning with the chrome tanning liquor made from the chrome precipitation recycled in leather processing

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ABSTRACT: The tanning effectiveness of the chrome tanning liquor (CTL) made from the chrome precipitation recycled in leather processing and dissolved with sulfuric acid was modified on basis of basicity adjusting and multi-ligands masking. The effects of the key factors influencing on the basicity tanning effectiveness of chrome tanning liquors were investigated. The results indicated that the tanning effectiveness of CTL was mainly affected by its pH value, the rate and temperature of pH adjusting. Then the CTL was basified to pH 4.0 around with 1.0 mol/L NaOH at differing rate at 45 °C, and chromium tanning was carried out at the beginning pH of pickling about 2.8 and end pH 4.0. The results showed that when the pH of CTL was adjusted at the rate of 0.2 mL/min, the shrinkage temperature reached to 95 °C, the Cr uptake rate could reach to 85% around, the chromium content and distribution in the leather was as high and uniform as that in the wet-blue leather tanned by the commercial tanning agent. The possibility of promote Cr absorption by the masking with chromium ligands was also investigated. The results showed that masking with the synergistic effect of multi chromium ligands could raise the Cr uptake rate to 95% around, and chromium distribution in the leather was more uniform. The novel method for modify CTL, improves Cr recycling and obviously reduces the chromium discharge in leather processing.

046 Improvement of chrome-free tanned leather quality using an enzymatic bating technology

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ABSTRACT: Environmentally friendly chrome-free tannages have received more and more attention in the leather industry. However, their application is limited, and an important reason is that most properties of chrome-free tanned leather are inferior to those of chrome tanned leather. An effective method for improving the sensory and physical properties of chrome-free tanned leathers is essential to promote a large-scale application of chrome-free tannages. Here, three popular types of chrome-free tanned leathers, such as vegetable tanned leather, chrome-free metal tanned leather and aldehyde tanned leather, were bated with proteases to improve the leather quality.The results showed that acidic protease transferred slowly in the chrome-free metal tanned leather, but acidic and neutral proteases easily penetrated the vegetable and aldehyde tanned leathers, respectively. The three chrome-free tanned leathers had higher yield, softness, tensile strength and tear strength after enzymatic bating. The bating technology is beneficial to improvement of chrome-free leather quality.

047 Lipase Enhances Unhairing by Protease: An Approach for Cleaner Bio-Based Pretanning Process for Sustainable Leather Manufacture

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ABSTRACT: Unhairing is one of the important operations in leather processing where hair is removed by using suitable chemicals. Conventional unhairing is based on application of huge amount of chemicals such as lime and sodium sulfide that generate huge amount of pollution load. A major cause of lethal accidents in tanneries is due to the use of sodium sulphide in unhairing. Enzymes assisted dehairing is an eco-friendly option that reduces pollution load in leather manufacture. However, complete removal of hair is still an issue of concern for unhairing using enzymes. CLRI had developed a novel protease for unhairing and the effectiveness of this protease unhairing in the presence of lipase and amylase as co-enzymes in processing are studied and presented in this paper. The use of amylase followed by protease and lipase after protease did not make any significant impact in enhancing the unhairing efficacy of the protease. However lipase before protease treatment improved the unhairing efficacy. The use of 1% lipase followed by 4% protease treatment resulted complete unhairing of skins compared to other combinations. The enzymatically dehaired leather was further analyzed by scanning electron microscopic (SEM) which showed complete removal of hair in the experimental process (1% Lipase followed by 4% protease). The pollution load such as BOD, COD, TOC, TDS and TSS were reduced by 89.38%, 88.57%, 85.79%, 47.37% and 48.57%, respectively when we compared to conventional process. The leathers processed by the optimized unhairing system also showed comparable strength characteristics with reference to conventional leather processes. This work clearly establishes that the presence of co-enzyme lipase has a significant impact on the unhairing efficacy of protease based unhairing system. Hence a total bio-based beamhouse processing in leather manufacture is now feasible.

Key words:

› *Cleaner process, enzymatic unhairing, Co-enzyme, waste management and leather process.*

048 Metal-Free Leather Tanning Technology Based on Active Chlorine Tanning Agent and Vegetable Tannins

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ABSTRACT: This work presents a novel eco-friendly metal-free tanning system based on active chlorine tanning agent (ACl) and vegetable tannins to effectively eliminate potential environmental and human health risks of metal salts as well as to improve leather performances. The results indicate that the enhanced hydrothermal stability and reasonable organoleptic properties of leather are closely related to the types and dosage of tannins in the ACl-tannin combination tanning process. The novel metal-free tanning approach selected as 10% ACl and 20% Wattle can endow the leather with shrinkage temperature (Ts) above 90 °C, implying the presence of synergistic effects between ACl and Tannin. In comparison to other tannins, wattle can be rapidly penetrated and evenly dispersed between collagen fibrils without altering the native triple-helix conformation of collagen. Notably, the resultant leather exhibits color light, grain smoothness and improved physical properties without containing heavy metal, which be consistent with current Chinese standard requirements for shoe upper leather and furniture leather, an metal-free tanning development trend. These findings will be beneficial to developing sustainable metal-free leather processing towards eco-friendly leather manufacture.

049 Novel chrome-less leather processing based on polymethacrylic acid/layered double hydroxides nanocomposite

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ABSTRACT: In this work, polymethacrylic acid/layered double hydroxides (PMAA/LDHs) nanocomposite is synthesized by in-situ polymerization and characterized by fourier transform infrared (FTIR) and transmission electron microscope (TEM). A chrome-less leather processing based on PMAA/LDHs nanocomposite has been reported. Our results show that the tanning system of 6% PMAA/LDHs combined 2% basic chromium sulfate increases shrinkage temperature (Ts) of the leather to 87 °C. The introduction of positively charged LDHs can improve the absorption and fixation of anionic dyes and fatliquoring agents, giving a pleasant dyeing property and softness to the leather. Thechrome-lesstanning approach also enhances strength propety of the rsulting leather.Moreover, addition of the nanocomposite can improvethe chromum exhaustion and reduce the chromium load in the wastewater. The biochemical oxgendmand (BOD) and chemical oxygen demand (COD) rsults suggest the chrome-less system witha beter biodegradability.

050 Optimizing fungal unhairing in bovine skin with Fusarium oxysporum

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ABSTRACT: The global context of climate change and the events related to the origin of the COVID-19 pandemic call for a paradigm shift in industrial process technologies. Enzymatic unhairing is presented as a sustainable alternative: not only reduces the emissions of hydrogen sulfide, but its biotechnology obtaining is friendly to the environment. However, their characterization through their enzymatic activity and histological action is necessary. Fungal enzymatic extract (EE) was obtained in a batch liquid medium using substrate from hair-saving unhairing process. Keratinolytic activity (quantitative test) was 2.7 U ker and protein 0.6 µg / ml. EE was tested at laboratory scale on submerged bovine skin with biocide 0.2% w/w, anionic 0.1%, non-ionic 0.5% tensioactives in soaking and unhairing, incubated at 37°C in shaking. Different conditions of EE were tested: dilutions (1:1, 1:2, 1:4) with buffer Tris-HCl 0.1 M, pH 9 and incubation times (24 h and 48 h). Controls were tested in the same conditions without EE. Samples of skin were observed by SEM. According to the morphological changes, score was defined to the following parameters: hair, epidermis with normal patterns; detachment of hair follicle sheath; absence of epidermis; empty hair follicles-visible dermal papilla. Results have shown the highest values with EE 1:1, 48 h and 24 h. In 1: 4, 24 h and 48 h, the average values were lower, control samples were close to zero. In conclusion, the observations have shown a linear correlation between the EE conditions and its action on the skin.

Optimizing fungal unhairing in bovine skin with Fusarium oxysporum

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051 Partial Nitrification of Sludge Digester Effluent in Sequencing Batch Reactor: Identification of Most Significant Factors to Link with Anammox Reactor

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ABSTRACT: Biological transformation of nitrogen results in the generation of sludge which needs a sustainable solution. Anaerobic digestion of these sludge yield energy and reduce the sludge volume significantly. The digestion of excess sludge from the SBAR reactor in this particular study yield a biogas yield of 193.2 ml/g VSS and the digester reached steady state in about 30 days. However, the supernatant after anaerobic digestion contains a significantly high concentration of ammonia (i.e., 1097 mg/l) which again needs sustainable solution. Partial nitrification (PN) of the supernatant after anaerobic digestion is a sustainable alternative to remove the nitrogen either through the partial nitrification-denitrification route or through the partial nitrification-anammox route. Though the PN-denitrification route may result in the generation of unwanted N2O gas. Therefore, the PN-anammox route is more sustainable. For the PN-anammox route, the NH4-N in the wastewater needs to be partially nitrified to NO2-N in the ratio of 1:1. As a result, the SBAR reactor was operated at SRT of 7 days, DO of 1 mg/L, pH of 8, at ambient temperature and cycle time of 8 h to start up the PN process, and the reactor was started up in 30 days with the required NO2-N: NH4-N ratio for anammox reactor feed. Moreover, the effect of various operational factors on the response variable (NO2N: NH4-N) was studied by considering seven operational factors (i.e. pH, DO, temperature, Cycle time, C/N, MLSS and aeration strategy (intermittent and continuous)). Fractional factorial design (Placket-Burman) was used to study the effect of the seven operational factors. The study showed that the individual factors considered for the study are not significant but the interactions between the factors are more significant. The results from experimental runs showed that it is possible to reach stable partial nitrification with high pH (7.60), low C/N (0.5), high cycle time (10 h), low DO concentration (1 mg/L), low MLSS/MLVSS (3500 mg/L), high temperature (32°C) and intermittent aeration.

Key words:

› *Anaerobic-Digestion, Partial-Nitrification, ANAMMOX, SBR.*

052 Practical Solutions for Deploying Polymer Sphere Technology at Production Scale

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ABSTRACT: The potential benefits of polymer sphere technology have been known for many years. The enhanced mechanical action provided by the spheres enables the reduction of water (typically by 30% to 40%) and chemicals (typically by 10% to 15%) in the tanning and retanning stages of leather production. Although these benefits have been successfully demonstrated both at the R&D scale and with pilots in production drums, tanners' concerns about the practical challenges with using spheres in full scale production have limited their broader adoption to date. To better understand and address these challenges full production scale installations were completed in Mexico and Brazil.

This presentation summarises the solutions developed to address the key challenges in adopting spheres at production scale without adversely impacting the operations of the tannery. In particular, the following challenges were addressed:

1. Providing a low-cost and low-footprint solution for storing spheres
2. Providing an efficient dosing mechanism for loading spheres to drums so as not to lower productivity
3. Effectively containing spheres in desired locations
4. Separating spheres from hides at the end of processing
5. Cleaning spheres to enable reuse.

053 The Ecotoxicity of Leathers under Different Tanning Methods

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ABSTRACT: End-of-life is important when determining a materials sustainability credentials. Raw hides/skins are naturally biodegradable and, therefore, leather can play a key role in a sustainable circular future. The addition of chemicals during tanning alters the disintegration rate and, different chemical methods likely produce leather with various toxicity levels. Leather samples tanned using different methods were analysed for detectable values of common toxins. Ecotoxicological screening was carried out on 5-samples of each type of leather (chrome-tanned, chrome-free and vegetable-tanned). Chromium-tanned leather had significantly more detectable levels of chromium than other leathers. Vegetable-tanned leathers had significantly more detectable levels of extractable petroleum hydrocarbons compared to other samples – which is highly dependent on fatliquor and finishing application methods. At end-of-life, toxins from biodegradable leathers may contaminate soil. Oxidants within soil oxidise Cr (III) to more toxic Cr (VI). Chromium is sometimes taken up by plants, impacting growth and development, due to its structural similarity to other essential nutrients. Petroleum hydrocarbons negatively impact soil enzyme activities, which alters nutrient availability. Toxins within soils may affect organisms directly through ingestion or indirectly through bioaccumulation which poses a risk to human health. Although the tanning method influences the ecotoxicological screen, the leather-making process is diverse (depending on desired leathers properties and application) and, therefore, tanning type is not an accurate determinant of leather toxicity. Furthermore, the ecotoxicological screen is not comprehensive and, therefore, compounds with high toxicity may not be currently detected. Ecotoxicological screening methods should be improved to cover all compounds of concern.

054 Treatment and Resource Utilization of Chromium-containing Tanning Wastewater Based on Natural Biomass Hydrogel

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ABSTRACT: In the tanning process, about 30%-40% of Cr(III) was discharged into wastewater, causing serious pollution to the environment and also excessive waste of chromium resources. Based on the advantages of natural biomass hydrogels, a strategy of adsorption treatment and resource utilization of adsorbates/adsorbents for chromium tanning wastewater has been proposed. Herein, chitosan-sodium alginate (CS-SA) hydrogel was successfully synthesized with a loose network structure. Adsorption experiments showed that Cr(III) adsorption on CS-SA was pH- and adsorbent dose- dependent, and had a lowest Cr(III) concentration. Adsorption kinetics and equilibrium model fitted results showed that adsorption process of CS-SA for Cr(III) was based on the coordination reaction between carboxyl group and Cr(III), and a higher concentration of Cr(III) facilitated such process. The final adsorption capacity reached 25.20 mg/g when CS-SA was used for the treatment of Cr(III)-containing tanning wastewater, indicating that the existence of competitive ions and impurities did not reduce the adsorption performance of CS-SA. Finally, the transformation of CS-SA-Cr(III) gel to CS/SA/Cr(III) sol was realized by the mechanical action of drum and hydrothermal degradation strategy. Then, the sol was directly applied to the retanning and filling of sheepskin wet blue leather. Based on the tanning effect of CS, SA and Cr(III), the shrinkage temperature of leather was increased by 3℃. Due to the filling performance of CS and SA, the leather was thickened by 0.7 mm. The tensile strength of the leather reached 12.77 MPa, and the leather was softer and fuller, so as to realize the resource utilization of adsorbates/adsorbents.

055 Collagen hydrolysate extracted from raw hide solid waste for the crop seedling cultivation

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ABSTRACT: The present study focused on the utilization of collagen hydrolysate with different molecular weights extracted from raw hide solid wastes to prepare organic fertilizers for crops breeding. Firstly, the single factor and orthogonal experiments were conducted to determine hydrolytic process parameters of raw hide solid waste for the Alcalase-based enzymatic and NaOH-based alkali, and alkali-enzyme methods, and three collagen hydrolysates were obtained. The molecular weights, heavy metals and amino acid compositions of the obtained collagen hydrolysates were investigated. Then, the collagen hydrolysates were used as organic nitrogen sources to prepare amino acid fertilizers for the cultivation of various seedings including wheat, soybean and rapeseed, and inorganic nitrogen solutions were used as controls. The effects of these nutrient solutions on the seedlings and growth of three crops were investigated. Concretely, the germination rate, plant weight, seeding height, soluble sugar and chlorophyll contents were determined. Results indicated that all the amino acid fertilizers containing collagen hydrolysate can significantly accelerate the germination, plant weight, and seeding height for the seedings, and greatly increase soluble sugar and chlorophyll content in leaves. Furthermore, the fertilizer efficiencies of all the tested hydrolysates are much better than that of the control group (fertilizer containing inorganic nitrogen). All the proteolytic nutrient solutions with different molecular weights can promote the growth of crops, but the smaller the molecular weight is, the better the growth effect of crops is, which is manifested in the higher germination rate, plant weight, seedling height, soluble sugar and chlorophyll contents of seeds.

Key words:

› *Raw hide solid waste; Collagen hydrolysate; Crop; Seedlings*

056 Comparison of two substrate protection approaches to applying the calcium handling for improving the resistance of collagen proteolysis

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ABSTRACT: Enzymatic dehairing, as a key part of cleaner leather processing, has reached processive advancement with potentially replacing the traditional hair removal due to increasing pressure from environmental demand. However, this cleaner technology ba sed on proteases has a problem that the hide grain is susceptible to be hydrolyzed, decreasing the quality of finished leather. Two methods for protecting the hide grain during enzymatic dehairing processing were chosen, utilizing calcium ions and calcium salt, respectively. The results showed that calcium ions had a swelling effect on collagen fibers under near-neutral conditions (pH 6.0-10.0), decreasing the thermal stability of collagen and the resistance of collagen proteolysis significantly. The alkaline environment (pH 10.0-12.0) will promote the dissociation of carboxyl groups in hide collagen, making for combining calcium ions and carboxyl groups. This strategy can change the surface charge of collagen fibers and enhance the connection inside collagen fibers, improving protease resistance and thermal stability of collagen. In the calcium salt handling method, calcium phosphate coating and mineralization can form a micron-level insoluble calcium salt protective layer on the surface of collagen fibers, which improves the thermal stability and protease resistance of collagen fibers. Comparing these two collagen protection methods, pretreating animal hide with a solution containing calcium ions or calcium salts can improve the protease resistance of hide grain, making the hide grain well-protected, especially calcium ions handling under alkaline conditions. This method provided a new way to establish a safer enzymatic unhairing technology based on substrate protection.

057 Ecosystem Services of East Kolkata Wetland (EKW): A Review

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ABSTRACT: The East Kolkata Wetland (EKW), also a designated Ramsar site (No.1208) located adjacent to the Kolkata megacity is mostly affected by numerous adverse environmental impacts of rapid urban development. Situating at the eastern fringe of Kolkata, EKW covers an area of 12,500 ha after losing 37% and 75% wetland and water spread area respectively. At least 538 tanneries in three tannery agglomerates and approximately 5,500 small-scale industrial establishments contribute to the large volume of effluent that flows past the EKW areas. Huge composite effluent mixed city sewage (around 50,000 m3d-1) and 2000–3000 tons of solid wastes from Kolkata is discharged in the raw state, without any pre-treatment, drained into the EKW ecosystem. EKW has been providing multi-dimensional services to the society and environment for the last 80 years. EKW acts as a natural sewage treatment plant of Kolkata as the complex network of microbes, 40 algae species, 2 fern, 7 monocots, 21 dicots and 40 fresh-water and brackish-water fish species aided by sunlight, suitable temperature, dissolved oxygen in the water cleans the wastewater of Kolkata. Hence, the world's only fully functional organic sewage management system saves Kolkata an expenditure of US $125 million (cost of a conventional STP) and provides employment opportunities at the rate of 2 persons per hectare of wetland area. EKW naturally traps elements by phytoremediation and metal chelation. Internationally, EKW is one of the best-known natural systems for resource recovery and utilization. 10915 metric tons of fish fulfills one-third of the annual demand in a city of over five million people and nearly 370650 kg-1 ha-1 vegetables are produced daily in exchange for 2000-3000 metric tons of solid wastes. EKW acts as a major carbon sink and makes Kolkata a potential option to become an exemplary participant in mitigating global climate changes. The unique piscicultural and agricultural practices of EKW are witness to an indigenous tradition of three generations of knowledge.

058 Exploration of Footwear Sole from Styrene Butadiene and Natural Rubber with Chrome Shaving as Filler

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ABSTRACT: This study would help to remove hazardous pollution during huge amount of chrome shaving are dumping into the environment not legitimate way.

059 Facile synthesis, surface activity and aggregation behavior of nonionic hybrid surfactants bearing a hydrocarbon chain and short fluorocarbon chain

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ABSTRACT: Conventional fluorocarbon surfactants with high toxicity, bioaccumulation and used cost due to long fluorocarbon chains (CxF2x+1, x > 7) are difficult to extensively apply to leather industry, although they have high surface activity, thermal and chemical stability. To address above problems, we synthesized a series of nonionic hybrid surfactants bearing a hydrocarbon chain and short fluorocarbon chain (Hm-Fn, where m = 10, 12, 14, 16 and n = 4, 6, respectively) via facile multi-step coupling reactions where the hydrocarbon chain endowed them with low economic cost and the short fluorocarbon chain decreased their toxicity as well as bioaccumulation. The results showed that Hm-Fn possessed very low critical micellar concentrations (cmc) where the cmc of H16-F6 could reach the minimum (0.063 mmol/L). Furthermore, dynamic light scattering and transmission electron microscopy analyses disclosed that Hm-Fn could self-assembly into vesicles in aqueous solution and changing the values of m and n could adjust the sizes of vesicles. Above findings provided a novel facile process to prepare eco-friendly and low-cost fluorocarbon surfactants, which was conductive to their development in leather field.

060 Green synthesis of bi-functional iron embedded carbon nanostructures from collagen waste for energy and environmental remediation applications

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ABSTRACT: Functional materials displaying diverse properties simultaneously are in great demand in various fields. Here, reported is the synthesis and application of bi-functional iron embedded carbon nanoparticles from collagenous tannery solid wastes. A simple and scalable high temperature heat treatment transforms highly insulating and paramagnetic collagen-FeCl3 scaffolds into perfectly conducting and ferromagnetic bi-functional iron embedded carbon nanoparticles. The structural and morphological studies show that different phases of Fe nanoparticles are embedded in the graphitized carbon matrix forming a core- shell type of nanostructures. The as-synthesized iron embedded carbon nanoparticles exhibited a mesoporous structure with pour diameter of 5.02 nm. The as-synthesized mesoporous nanoparticles exhibited an exceptional photocatalytic activity towards 100% degradation of methylene blue dye within 80 min of sunlight irradiation time. The as-synthesized iron embedded carbon nanoparticles also showed an outstanding Li+ storage property with large reversible specific capacity (~384 mAh/g) after 75 cycles. The results provide a cost-effective, scalable and sustainable approach for the synthesis of functional nanomaterials from industrial bio-waste for applications in energy and environmental remediation.

Key words:

› Collagen, Carbon nanoparticles, mesoporous, ferromagnet, photocatalytic activity

061 Light Weight, Flame Resistance and Heat Dissipation MXene/Cross-Linked Collagen Fibers Composite Aerogel for Sensitive Pressure Sensor

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ABSTRACT: Flexible wearable pressure sensors, which are composed of conductive materials and elastic polymers, have attracted tremendous interest for applications in human health monitoring, human-machine interfaces, bionic limbs and so on. Collagen fiber (CF) is a traditional biomass material with the characteristics of non-toxic, degradable, good flexibility, excellent biocompatibility, porous structure and abundant functional groups, and it can be used as base material for environmentally friendly flexible pressure sensors. MXenes, which are 2D layered nanomaterials with a large specific surface area and high conductivity, are widely employed in electrochemical energy devices. In this study, cross-linked collagen fibers (CCF) prepared by glutaraldehyde treated CF for better mechanical properties was combined with MXene to obtain MXene/CCF composite aerogel. The interaction of hydrogen bond between CCF and MXene was confirmed by FT-IR. The gradual change of the 3D porous structure of MXene/CCF composite aerogel during the compression and rebound deformation process could improve the sensing performance. Verified by a series of experiments, the MXene/CCF aerogel sensor showed a sensitive sensing property (61.99 kPa-1), low detection limit (0.7 kPa), quick response time (300 ms), and recovery time (150 ms), which played a flexible role in detecting human movement. In addition, the MXene/CCF aerogel, as a multifunctional material, showed excellent flame resistance and heat dissipation property against cool down by itself from greater than 420 ℃ to 25 ℃ in 70 s. This research provided a new thought for the high-value utilization of leather or CF, and could expand the application fields of leather.

062 Solid leather waste for preparation of value added composite products; an Ethiopian perspective

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Leather, environmental

ABSTRACT: Ethiopia is a country with huge livestock resources rated as first ranked in Africa and 10th in the world but the utilization on these resources is limited due different constraining elements of the livestock products as well livestock by products like hide and skin which has deteriorated quality that may be attributed as the result of lack of improved management and advanced technologies among others and these on the other hand resulted in huge waste generation. If these wastes are not managed wisely and properly can impose environmental and societal health problems. The objective of the present study therefore was, to prepare composites by incorporating solid leather waste with sisal plant fiber using three different binders namely resin, polyurethane and natural rubber latex. The composites prepared were characterized for their physical properties (tensile strength, elongation at break, stitch tear strength, water absorption, water desorption and flexing strength). In all of the binders 40 percent sisal composite in those prepared using resin binder, 40 percent in those prepared using polyurethane binder, and 30 percent sisal composite in those prepared using natural rubber latex had optimum results in their tensile strength (Mpa) which is the major parameter. These prepared composite products can be used as raw materials for preparation of different items like stiff hand bags, ladies' purse, keychain, chappal upper, wallet, wall cover, mouse pad and other interior decorating products. By preparing such value added composite products from the solid waste leather, we can reduce solid waste; minimize environmental pollution and thereby securing environmental sustainability and/or can be used as income generation and employment opportunity.

Key words:

› *Ethiopia, composite, solid waste, plant fiber, binder.*

063 Study on the Kinetics of Co-pyrolysis of Wet Blue Leather Shavings and Straw

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ABSTRACT: In this work, the kinetic behavior and evolution characteristics of the mixture of straw (ST) and wet blue leather shavings (WLS) during the co-pyrolysis process were studied. The ST was blended with WLS in three blending ratios: 75 wt.%, 50 wt.% and 25 wt.%, and then heated from 35 to 600 ℃ at 10, 30 and 50 ℃/min under N2 atmosphere with a flow rate of 40 ml/min. The initial decomposition temperature of ST was lower than that of WLS, but the maximum pyrolysis rate of straw was much higher than that of the WLS. The residual material of ST after pyrolysis was lower than that of WLS, and the residual material of the three blending ratios were between the two components. The co-pyrolysis could improve the pyrolysis performance of both components. The pyrolysis curves of the TS/WLS blends in different proportions could be simulated by utilizing the pyrolysis data of TS and WLS. It was found that the simulated data and the experimental data had the best fit when the straw ratio was 50 wt.%. Two iso-conversional methods of Ozawa–Flynn–Wall (OFW) and Modified Kissinger–Akahira–Sunose (MKAS) were used to calculate the activation energy. A lowest average activation energy was obtained when the weight ratio of ST was 75 wt.%.

064 Synergistic effect of Layered double hydroxide-graphene on flame retardancy and smoke suppression of bio-based casein nanocomposite

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ABSTRACT: Fabrication of layered double hydroxide-graphene (LDH-rGO) is considered as an accessible and effective technology to improve flame retardant and smoke suppression performance of systems. Herein, co-precipitation method was used to synthesize a hybrid of LDH-rGO, which was used as a flame retardant and introduced into the casein substrate. The composition, structure and morphology of LDH-rGO were characterized by FTIR, XRD, TEM and TGA. It was found that LDH-rGO had been successfully prepared. Further, the effects of LDH-rGO amount on flame retardancy and smoke suppression of finished leather were studied. The LOI value of finished leather was increased from 24.1% to 27.4% by using 5% of LDH-rGO. Heat release rate (THR) and smoke release rate (SPR) of finished leather were decreased dramatically. Typically, 36% and 69% reduction in peak heat release rate and smoke release were achieved with 5% LDH-rGO. This dramatically reduced fire hazard was mainly attributed to the synergistic effects of LDH and rGO, which is non-combustible gas released between layers of LDH. Meanwhile, MgO and Al2O3 generated from LDH-rGO in the combustion process helped enhance the production of char residue and raised the compactness of the char layer. This work provides a feasible pathway for preparing green and efficient flame-retardant leather finishing materials.

065 The rheological behavior of collagen solutions cross-linked by series of oxidized dextran

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ABSTRACT: Nowadays collagen-based scaffold materials are widely used for tissue engineering because of their many advantages, including lack of antigenicity, abundant availability, bioresorbability and biocompatibility. Since the collagen products are produced by collagen solutions and the mechanical handlings could influence their properties. Therefore understanding the rheological behavior of collagen solutions is of vital importance. In this study, the rheological behavior of collagen solutions crosslinked by oxidized dextran T70, oxidized dextran T200 (referred to as ODex70, ODex200) is carried on through steady-state shear performance, dynamic viscoelasticity and thixotropy test. The steady-state shear results showed that all the modified collagen samples exhibited typical "shear thinning" behavior and the viscosity of the ODex70-modified collagen solution was less than that of ODex200-modified collagen solution at the same ODex dosage, indicating that ODex200 had a good cross-linking effect. The dynamic viscoelasticity results showed that the elastic modulus of modified collagen solutions were larger than the viscous modulus, reflecting gel-like property and tan δ (pure)>tan δ (ODex70)>tan δ (ODex200), indicating that ODex200 cross-linking effect was better. The thixotropy results showed that the area of the thixotropy ring first increased and then decreased with the increase of the ODex70, which was related to the stability of the solution. With the increase of the amount of ODex70, the energy required to destroy the structure of the material was larger and the area of the thixotropic ring became larger accordingly. Therefore under the action of shearing, the modified collagen aggregation state was resistant to shear and recovers quickly.

Key words:

› *Collagen, Oxidized dextran, rheology*

066 The skin as raw material for leather manufacture – are there vegan alternatives?

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ABSTRACT: In Europe and in North America, the market for vegan alternatives to leather is increasing aiming to replace animal-based materials. In parallel, bio-based raw materials should be used instead of fossil-based synthetic raw materials. We investigated a shoe upper leather, an artificial leather, and a couple of alternative materials basing on different marketed partly or fully plant based materials. We aimed to compare their structure and technical performance, which allows an estimation of possible application areas. Structure and composition were characterized by microscopy and FTIR spectroscopy, the surface properties, mechanical performance, water vapor permeability, and water absorption by standardized physical tests. None of the leather alternatives showed the universal performance of leather. Nevertheless, some materials achieved high values in selected properties. It is speculated that the grown multilayer structure of leather with a very tight surface and a gradient of the structural density over the cross-section causes this universal performance. Further the hydrophilic behaviour of the protein collagen causes the comfort properties. The structure which originates from the structure of the skin is preserved by tanning. To date, the leather structure and its performance could neither be achieved with synthetic nor with other bio-based materials.

067 Utilisation of various solid leather wastes for the production of blended bricks

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ABSTRACT: Developing low cost blended bricks for use in construction industry from differnt solid leather wastes is an efficient way of waste utilisation and environmental pollution prevention.Soil and they are mixed with various types of solid leather waste like chrome shavings powder, buffing dust powder and finished leather powder to prepare soil:chrome shavings bricks, soil:buffing dust bricks and soil:finished leather bricks. These bricks were characterized for their physicochemical and mechanical properties. Scanning electron microscopic images revealed the structure and compactness of the bricks. Mechanical properties of bricks were promising, which enables their use in construction industry applications. Hence, the study has unravelled a novel concept of bricks manufacture which isenergyefficient,eco-friendlyandcosteffective.

068 Waterborne Polyacrylate/ sulfonated Graphene Composites with high - efficiency Electromagnetic Interference Shielding for Leather Coatings

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ABSTRACT: With the explosive development of wireless equipment and 5th generation wireless systems, leather products with high-performance Electromagnetic Interference (EMI) shielding are highly desirable for protecting human beings from harmful electromagnetic pollution in daily life. Herein, highly exfoliated graphene oxide with less defects (LGO) was prepared by a combination of less oxidant dosage (only 1/3 of the original dosage) and ultrasound-assisted Hummers' method to maintain the structural integrity. Then, thermally reduced graphene oxide and commercial graphene nanosheet were sulfonated to be water-dispersible by an aryl diazonium salt, and finally, sulfonated reduced graphene oxide (S-rLGO) and sulfonated graphene nanosheet (S-GNS) were integrated with waterborne polyacrylate latex (P(St-BA)) to serve as EMI shielding composite coatings for leather via a blending method, respectively. The mechanical properties and EMI shielding performance of the two composites were systematically investigated. LGO was demonstrated to possess both good structural integrity and exfoliation degree. Due to the π-π interaction between graphene and polymer, both the P(St-BA)/S-rLGO and the P(St-BA)/S-GNS composites exhibit strong mechanical properties. Moreover, the P(St-BA)/S-GNS composite possesses a higher conductivity than that of the P(St-BA)/S-rLGO composite, thereby showing high-efficiency EMI shielding performance. The P(St-BA)/S-GNS composite with a filler loading of 25 wt% possesses a high EMI shielding effectiveness of 21.5 dB at 0.05 mm thickness, which remains unchanged after 1000 times bending. The flexible P(St-BA)/S-GNS composite could be applied on the surface of the leather, which makes the coated leather a great prospect for EMI shielding application in human protection.

069 Preparation and characterization of Graphene-based adsorbent for Cu(II) and Cd(II) removal from tannery wastewater

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ABSTRACT: In this study, graphene oxide (GO) was synthesized from commercial graphite flakes for the adsorptive removal of copper (Cu2+) and cadmium (Cd2+) from harmful tannery effluents. Various analytical methods viz. X-ray diffraction, Field emission scanning electron microscopy, Zeta potential charge, and Fourier transform infrared spectroscopy were employed to evaluate the surface morphology and chemical nature of prepared GO. The adsorption experiments were conducted through a batch process under a constant stirring condition (200 rpm). The operational parameters (OPs) were optimized to find the maximum metal adsorption capacity. The plausible sorption mechanism, sorption nature, and randomness were interpreted in terms of isothermal, chemical kinetics models, and thermodynamic study. GO is prone to adsorb metal as it is deprotonated and anionic nature at higher pH. The highest metal removal was observed at pH 6 for Cu(II) and 7 for Cd(II). The metal removal capacity for each metal was positively correlated with the other OPs of the adsorption process. The sorption of the metal ions followed both Langmuir and Freundlich isotherms showing a complex (both monolayer and multilayer) adhesion phenomenon and the maximum removal capacity (qm) of cadmium (231.48 mgg-1) was higher than that of copper (193.05 mgg-1). Moreover, the pseudo-second-order reaction model adequately described the chemical kinetics of each metal demonstrating a chemisorption nature of the adsorbent. The adsorption process was spontaneous at ambient temperature and exothermic. Thus, the GO can be an efficient and affordable adsorbent for the removal of these toxic heavy metals from tannery wastewater.

070 A more sustainable chrome tanning process with high chrome exhaustion

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A more sustainable chrome tanning process with high chrome exhaustion
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ABSTRACT: Currently, the leather industry faces multiple challenges because of the regulations enforced by several pollution control agencies to reduce the level of chemical pollutants in the treated water. Chrome tanning is one of the most polluting processes due to the presence of Cr(III) in the wastewaters. This problem can be solved by high - exhaustion chrome tanning technology. In this study, an acrylic copolymer was used as a tanning auxiliary. This approach introduces more binding sites with carboxyl groups onto collagen fibers, leading to numerous benefits such as significantly enhanced chromium fixation and reduced chromium discharge in wastewater. The properties of leather obtained with this new technology were compared with traditional chrome tanning. Physical tests as shrinkage temperature, tensile strength and tear strength were carried out. Moreover, the environmental impact was evaluated by analyzing the tanning baths. All the results will be described in November at the XXXVI IULTCS Congress.

Key words:

› Chrome tanning, Chrome exhaustion, Tanning auxiliary, Tanning wastewater

071 ALTERNATIVE SUSTAINABLE GREEN TANNING AGENTS FROM STARCH

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ABSTRACT: Considering health & environmental awareness and existing legal limitations, generating alternative potential tanning agents from renewable natural sources with biodegradable property has big importance in terms of sustainability, human & environmental health. For this reason, many studies have been focused on the development of cleaner production methods and sustainable green chemicals. Due to its features that it is an abundant, inexpensive, biodegradable nature polymer, starch is an important raw material for producing sustainable green chemicals. For this reason, we focused on different modification techniques of native corn starch for possible utilization in leather making as a tanning agent. For this purpose, two modified starches that can be used in leather production were produced by periodate oxidation and carboxymethylation methods. Regarding each method; product yields, water solubility and degree of substitutions were determined. The obtained products (dialdehyde starches and carboxymethyl starches) were characterized in detail by Proton Nuclear Magnetic Resonance Spectroscopy, Fourier Transform Infrared Spectroscopy and Gel Permeation Chromatography. The selected samples were used in the tanning process. Their tanning abilities were evaluated by investigating hydrothermal stabilities, filling and fiber isolation characteristics and physical properties determined by mechanical tests and organoleptically. The obtained results revealed that properly modified starches can be a good alternative as sustainable green tanning/retanning agents in leather production.

072 Can the sustainable bio-based aldehyde be used for the synthesis of environmentally-friendly melamine resin retanning agent

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ABSTRACT: In this work, we proposed a new strategy to prepare formaldehyde-free melamine resin (BMR) by using bio-based aldehyde (BAT) derived from renewable saccharide and melamine as raw materials. The possibility of BAT used as the condensing agent and the retanning properties of BMR were investigated. FTIR and NMR analyses showed that the aldehyde groups of BAT successfully reacted with the amino groups of melamine. GPC measurement showed that the weight-average molecular weight of BMR could be up to 4849 g/mol when the mole ratio between BAT and melamine was 1:1. Retanning experiments indicated that the tensile and tear strengths of BMR filled crust leather (BMR crust leather, similarly hereinafter) were better than those of conventional MR (CMR) crust leather. The softness and general appearance of BMR crust leather were comparable to those of CMR crust leather. More importantly, CMR crust leather had a formaldehyde-content up to 86.4 mg/kg while the formaldehyde content of BMR crust leather was much lower than the most stringent limit standard value (20 mg/kg), and close to the lowest detection limit value. These results suggest that the bio-based aldehyde can be used to synthesize environmentally-friendly MR retanning agent.

073 High-water vapor-permeable Antibacterial Casein-Based MOFs Leather Finishing

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ABSTRACT: Modern leather industry is trending towards green, functional and intelligent development, thus finishing materials must adapt to this development trend of leather industry. Casein shows good market competitiveness and broad application prospects in leather finishing because of its advantages including strong adhesive force, high loss and superior hygienic property, etc. However, the pristine casein film is hard, brittle, and intolerant to water and microorganisms. Therefore, in this study, casein-based MOFs leather finishing possessing better water vapor permeability and antibacterial property were obtained by introducing M-ZIF-8 with larger size prepared via in situ method using casein as the template into casein matrix. The structure and morphology of the composite material were characterized by Fourier transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), specific surface area analyzer (BET), scanning electron microscope (SEM), transmission electron microscope (TEM), etc., the hygienic and antibacterial properties of the finishing materials were investigated. The results showed that the dodecahedron M-ZIF-8 with a size of about 800 nm and a complete crystal structure was successfully prepared. When the dosage of M-ZIF-8 was 1%, the antibacterial effect of the composite emulsion on E. coli and S. aureus is the best (inhibition zone is 4 mm). When the dosage of M-ZIF-8 was 0.5%, the water vapor permeability of the composite film is the optimal, which is 972 mg/10 cm2·24 h. This research will provide significant theoretical guidance for the development and utilization of functional leather finishing materials and other functional coating materials.

074 pH-Responsive Pickering High Internal Phase Emulsions Stabilized by Waterborne Polyurethane

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ABSTRACT: Stimuli-responsive soft particulate emulsifiers have emerged as a class of smart materials that can permit regulated emulsification and demulsification of emulsions, which is essential for petroleum, pharmaceutical, food, and cosmetic industries. Herein, well-defined waterborne polyurethane (WPU) with 2,2-bis(hydroxymethyl)propionic acid (DMPA) side chains were prepared via polyaddition reaction. They can self-assemble in water to form nanoparticles with hydrophobic PU chains as the core and hydrophilic DMPA chains as the shell. The physical and interfacial properties of WPU nanoparticles can be controlled by pH values, which can be use as novel pH-responsive particulate emulsifiers to stabilize and destabilize oil-in-water (O/W) Pickering high internal phase emulsions (HIPEs). We also demonstrate that factors like the particle concentrations, internal phase fraction (ϕ), and the type of oils have a great effect on the formation and mean droplet size of resulting emulsions. The WPU-stabilized O/W Pickering HIPEs were quickly demulsified under acidic conditions whereas they showed markedly stability in alkaline solutions. Four successive cycles of emulsification–demulsification process were demonstrated by modulating the pH with the addition of acid or base without significant loss of stability. The intriguing properties of these pH-responsive Pickering HIPEs indicate their potential in several industrial applications such as fatliquors for leathers, oil transportation and recovery, emulsion polymerization, and heterogeneous catalysis.

075 Preparation of a polyhydroxy chrome retanning agent and its application in retanning process

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ABSTRACT: Surfactant is a kind of substance that can change the interface state of the solution system. A new type of organosilicon surfactant with hyperbranched structure was prepared from hydroxyl- terminal hyperbranched polymer and epoxy-terminated silicone oil. The ability of silicone surfactants to reduce the surface tension of water was measured by automatic meter/interfacial tensiometer, the wettability of silicone surfactants was tested, the influence of silicone surfactants on the contact angle was tested, and the role of silicone surfactants in the process of leather retanning was tested. The results show that the silicone surfactant synthesized in this experiment can significantly reduce the surface tension of water to 24.96 mN.m-1, it also has good wettability and can reduce the water contact angle, it can improve the leather softness, air permeability and other physical properties in the process of leather retanning. The content of chromium in skin samples was determined by atomic absorption spectrometry after digesting by microwave. The average chromium content of the leather with HBSi was 21.95mg /L, while that without HBSi was 18.80mg/L. The addition of HBSi increases the chromium content of the leather and allows it to absorb more chromium during the retanning process.

076 System innovation for more sustainable chemistry in the leather supply chains

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ABSTRACT: Under SDG 12, the United Nations have committed themselves to achieve, by 2020, an "environmentally sound management of chemicals and all wastes throughout their life cycle". In this respect, the leather supply chains are facing complex challenges. To overcome them, technical innovations - e.g. new bio-based tanning chemicals or optimized process flows - alone are not sufficient. For a broad uptake of these technologies, the incentives and perceptions of the actors in the global context must be analysed. In addition, the management of supply chains are crucial. Innovative forms of collaboration along the supply chain are essential, and so is a certain degree of formalization of new rules, developed by private industry standards and supported by legislative impulses. This interplay of technical, organisational and institutional innovations shows relevant perspectives of a "system innovation". A systemic approach is also required for the transformation towards a more sustainable chemistry in the leather supply chains. The contribution presents findings from an interdisciplinary, transformative research project at the Darmstadt University of Applied Sciences. This includes a scenario building process "leather 2035" together with actors from the supply chains, multi-stakeholder groups and NGO´s, as well as the creation of a "Theory of Change", defining a roadmap for the way towards the preferred scenario. The project builds upon continuous exchange with about 50, mostly European organisations. In a participatory process, the project identified and now addresses key leverage points of the required system innovation, including chemicals and process innovation, as well as IT tools and governance for traceability of chemicals along leather supply chains.

077 Biodeterioration of Vegetable-tanned Leather

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ABSTRACT: Fugal might thrive on tanned leathers, resulting in undesirable and irreversible changes in them, which does harm to the leather items. In the present work, the tannic acid-tanned leather was exposed to penicillium and aspergillus niger for up to 90 days to study the biodeterioration mechanism. The deterioration of structure, thermal stability, tensile properties and morphology of the leathers caused by microbiological attack were identified by Attenuated Total Reflectance-Fourier infrared transform (ATR-FTIR), Thermal Gravimetric Analyzer technology-Mass Spectrometer (TG-MS), Polarized Light Microscopy (PLM), Texture Analyzer and Scanning Electron Microscope (SEM). Both of penicillium and aspergillus niger could cause the mass loss, deterioration of grain layer and tensile strength of samples. Compared with after being treated with aspergillus niger, the tensile strength of one after being treated with penicillium for over 60 days is greatly reduced. Based on ATR-FTIR results, the relative intensity of bands at 1710 cm-1 and 1611 cm-1 relating to the vibration of C=O and C=C respectively from tannic acid decreased, which suggested the destroyment of the structure of tanning agent in the samples.

078 The preparation of fat-liquoring agent by waste oil from food industry and its properties

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ABSTRACT: China consumes about 40 million tons of animal and plant oils every year, of which about 15% will become waste oils, which are strictly prohibited to enter the food industry. Thus, the utilization of waste oils is an important research topic in this field. In this paper, a kind of waste oil from a local food processing enterprise was sequentially reacted with methanol, diethanol amine, maleic anhydride, sodium bisulfite, in order to synthesis a self-emulsifying fatliquor (SRO). The in-situ FTIR amd FTIR spectrum were used to investigate the structure of the intermediate products and SRO, it was proved that the structure of intermediate products and SRO was in accord with their molecular design. It was proved the emulsions of SRO were stable against 1 mol/L HCl solution, 1 mol/L NH3•H2O solution, 10%(w/w) tannin solution and 10%(w/w) potassium chromium sulfate solution. Finally, SRO was used in fat-liquoring of cattle wet blue, and it was proved that the physical and mechanical properties of leather increased greatly compared with the control.

079 Application of Nonionic Short Fluorocarbon Chain Surfactant as a Fatliquoring Auxiliary in Chrome-Tanned Goat Leather

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ABSTRACT: The fluorinated surfactant is a kind of special surfactants with high surface activity. Nevertheless, the conventional long fluorocarbon chain (CnF2n+1, n>6) surfactants have been banned in many industrial fields because of their seriously negative effects on the environment and human health. Addressing to this situation, a kind of environmentally friendly nonionic short fluorocarbon chain surfactants (Fn-Fn, n=2, 4 or 6) were successfully synthesized and used as fatliquoring auxiliaries for chrome-tanned goat leather. The results showed that the synthesized fluorinated surfactants presented outstanding surface activity, in which F6-F6 could reduce the surface tension of water down to 17.8 mN/m. The addition of Fn-Fn in the fatliquoring process could facilitate the penetration of grease into the leather fibers, thereby loosening the leather fibers and enhancing the softness of resultant leathers. The resultant leather treated with Fn-Fn also performed a good waterproof property, and the contact angle of water droplet on the resultant leather surface remarkably increased from 82° to 110°. This work expands the application scope of such types of novel nonionic short fluorocarbon chain surfactants and demonstrates that they are promi

080 Application of typical glycosidase in cattle hides soaking process

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ABSTRACT: Conventional soaking process is conduct in a salts, alkalis and surfactants containing liquor to remove un-wanted substances in hides/skins, and promote quickly absorption of water for the purpose of rehydration the salt-wetted raw hides/skins. Enzymatic assistant soaking process is being considered as efficient and benign technology options due to the reduction and replacement of harmful chemicals, meanwhile, the collagen fibers dispersion is comparable even better than that of conventional method. Enzymatic rehydration and fibers opening up using glycosidases is more safe and efficient soaking method than protease-based soaking operation. In this study, collagen fibers dispersion effect on cattle hides by using typical glycosidases was compared at the very beginning; then, appropriate soaking conditions of two superior glycosidases were optimized through rational experimental design. The results indicated that mannanase and xylanase produced more total sugar and soluble protein than that of cellulase,hyaluronic acid lyase, glucanase and glucosidase, which means that mannanase and xylanase have preferable soaking effect. The use of mannanase and xylanase in cattle hides soaking significantly removed proteoglycan and soluble protein, and properly opening up the collagen fibers. The suggested dosage for xylanase and mannanase soaking is 0.9% and 0.6% at 100% of water and 25°C, respectively. Furthermore, xylanase or mannanase can completely eliminate the use of surfactants, which is beneficial for the disposal of the leather making effluent.

081 Development of a novel enzyme unhairing system and its partical application

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ABSTRACT: Unhairing process brought serious pollution, and enzyme application for replacing polluting chemicals in unhairing process attracted much attention in recent years. A novel unhairing enzyme is obtained which possess high keratinase ability as well as low collagen degradability. It can be directly applied in unhairing-liming process, and also can be used in soaking process as an auxiliary agent. The physicochemical properties and sensory properties of leather producing with this unhairing enzyme can meet the requirement of national standards, and it is especially suitable for producing sofa leather. In addition, the solid waste including hairs and hide shavings can be recovered for making porous carbon, which can be used as adsorbing material and carriers of catalytic material in wastewater treatment.

082 Education for sustainable development of leather industry - challenges and pedagogical models

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ABSTRACT: Leather is one of the oldest and most sustainable material on earth. But then sustainability of leather industry is a much discussed topic in recent times. The three sustainability parameters viz., environmental, ethical& social and economic, all converge towards creating appropriate sustainable human resources development for the leather sector. This industry has its own specific challenges which needs to be addressed. The role of leather engineering education and training to meet these challenges and the methodologies and pedagogical models to solve these issues are discussed with a few select successful case studies drawn from different countries. Case studies with limited success stories are too analyzed for gaining insights into effective working models. Mechanisms to impart leather engineering skill sets suited to address current and future anticipated leather development challenges are discussed. Importance of competitive cooperation amongst different educational and training institutes and agencies is emphatically brought out and appropriate strategies for the same laid out. Ultimately, the rate determining step in the sustainability exercises for any industry is the Human Resources Development. Paradigm shifts in Education and Research Approaches and globally operative programes to attract the young millennials towards leather sector are explored and outlined.

083 Green financing for green entrepreneurship in leather sector – A new dimension to the environmental management

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Green financing for green entrepreneurship in leather sector – A new dimension to the environmental management
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ABSTRACT: Environmental woes and issues are almost synonymous with the leather manufacturing activity. In spite of numerous cleaner and greener technologies churned out by global research organizations, the solid, liquid and gaseous wastes emanating from the industry still burgeon and remain a cause of concern. Viable and pragmatic environmental solutions are still looming large. Thanks to it, the solid, liquid and gaseous wastes are unsustainably treated; The available greener technologies are perceived as burdens in terms of infrastructure, complexity of technologies/operations and competent human resource for managing the technologies etc. In such a scenario and in the absence of Sustainability/Green entrepreneurs, leather industrialists and entrepreneurs are hampered with the additional responsibility of environmental management of the leather sector as well. May be, that amounts to mismanagement of environmental issues on hand and stands as the reason for the perpetuity of the environmental agony associated with the activity. At this juncture, these environmental challenges should be visualized as sustainability/green entrepreneurial opportunities and exploited for value realization. If sustainability/green entrepreneurs evolve and focus exclusively on the waste management of the sector, the traditional linear economy model of the sector will substantially move towards a circular economy and the sector itself will stand sustainable economically, socially and environmentally. Thus, the paper will focus on positioning and frameworking of Sustainability/ Green Entrepreneurship in the very ecosystem of leather sector and specific green financing strategies to be adopted by them to lead the sector towards a circular economy model.

084 Precision laser cutting and anti aliasing process for high quality texture creation on leather

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ABSTRACT: Crust and finished leather requires advanced machinery for desired surface profiling. This process not only imparts different textures & cover natural defects but also imparts value addition .Processed leather specifically tanned and processed leather required advance machinery if needed to be cut or shaped in any sorts of special form factor. This segment of high quality leather is sensitive and require special processed and care to cut and get the required shape. Conventional tools and cutting tools may cause stretch marks and shifting of layers in leather. These damage can reduce the quality and can induce scratches and marks on the leather sheet. A major scope of development and improvement can be seen in this region and we can use advance cutting machines to help solve this problem . The solution presented in the paper uses the process of high power laser and controlled 2 axis motion. The result outputs are oriented to generate leather cuts with minimum damage and reduced stretch or burn marks.This not only maintain high quality standards but also allows to increase the production processes. In the paper we will discuss both advantages and disadvantages of both conventional and modern(Laser) based leather cutting.

085 Preparation and application of amphoteric polymeric retanning agent containing aldehyde groups

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ABSTRACT: An amphoteric polymeric retanning agent containing aldehyde groups (PADU) was prepared by copolymerizing reaction of acrylic acid (AA), dimethyldiallyl ammonium chloride (DADMAC) and undecylenic aldehyde (UDAL) and azodiisobutyronitrile (AIBN) used as an initiator. The structure of PADU was characterized by FT-IR and 1H-NMR. The charge characteristic of PADU solution was measured by Zeta potential analyzer. Then, PADU was applied as a retanning agent in non-metallic tanning system of F-90 to investigate its effect on dye-binding capacity of the retanned F-90 leather and physical and mechanical properties of the crust leather. Results showed that the structure of the main component of PADU retanning agent was a vinyl-based copolymer containing carboxyl, quaternary ammonium and aldehyde groups. PADU had the isoelectric point of 4.25. The application trial indicated that the PADU retanning agent can improve the binding capacity between F-90 tanning leather and anion dye during the retanning process. The dye absorption rate of the crust leather was up to 99% and the dyeing liquor was clear. Furthermore, color of the crust leather was uniform and full and its K/S value, thickening rate and physical-mechanical properties were higher tha

086 Preparation of elastin peptide and its application in phospholipid fatliquor

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ABSTRACT: Elastin peptide was prepared through enzymatic hydrolysis method by using bovine ligament as raw material, which was developed on the basis of response surface methodology (RSM). Then the oxidation resistance of the elastin peptide in phospholipid fatliquor was investigated. The results showed that the interaction between temperature and time was the main factor affecting the enzymatic hydrolysis. The elastin hydrolysis was increased to 12.9% by the optimal conditions of enzymatic catalyzation, i.e. water ratio to substrate 500%, temperature 60.0 °C, time 6 h, pH 10, enzyme dosage 2500 U/mL. Gel permeation chromatography analysis showed that the average molecular weight of the product was about 5000 Da (Mw). The antioxidant performance test indicates that ABTS free radical scavenging rate of the elastin peptide was as high as 95% which was much better than the other protein peptides. Moreover, it could improve the antioxidant of soybean phospholipid fatliquor and protected the fatliquored chrome tanned leather from odor and hexavalent chromium.

087 Shrink Reduction by adaptive controlling the process of guided and temperature controlled laser cutting machine

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ABSTRACT: High quality leather is usually recognised by the texture, shine , thickness and colour . This high quality leather is extremely sensitive to thermal and abrasive processes. With the implementation of heating or passive inducing machines that can use loss of texture and can cause shrinkage these high quality leathers are depreciated and the selling price and quality reduces to a great extent. Shrinkage is one of the most common damage that happens with the induction of high temperature of heat. This process of shrikage is not only induced with the effect of direct heating but is a passively induced while shaping or using shine improvement treatment with the help of glass. The presented solution is trying to reduce the output losses of such treatment and the cause of such processes by inducing high speed laser cutting to avoid shrinkage and to let the material expand after cutting. This high speed cutting produces extremely precise and powerful cuts without inducing any changes in sizes in the final cut piece

088 The application of virtual reality in leather physical analysis course

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ABSTRACT: The rapid development in information technology has huge opportunities to improve the engineering education in terms of methodologies, strategies and tools. Virtual reality is an artificial environment that is created with software and presented to the user in such a way that the user suspends belief and accepts it as a real environment. Leather physical analysis courses taught in School of Light Industry and Engineering at Qilu University of Technology mainly depend on the traditional teacher centered method. This research suggests a virtual environment technology as a tool to develop new educational approach for this course. This study developed a computer software (Leather physical analysis virtual reality system, LPAVRs) for this purpose to deal with leather physical analysis using virtual reality technology. The software is designed for distance education and engineering training purposes, which can present 3D model for certain physical test item using VR technology to do simulation experience for the students. This paper aims to introduce the LPAVRs and evaluate the applicability and feasibility of LPAVRs used in course teaching. The results show that the LPAVRs has the ability to achieve better teaching effect than those of the traditional teaching method. As a conclusion, using the LPAVRs as a tool in leather physical analysis courses is very useful and effective for the students.

089 The new sourcing landscape

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ABSTRACT: The process of sourcing is changing, rapidly. Traditionally, for leather products manufacturers, sourcing leather and other components has been an offline experience where personal networks and trade shows have been the main ways to find innovation, establish connections with new manufacturers and build relationships. Looking into Business-2-Consumer (B2C) dynamics, online solutions have taken market shares from traditional offline channels and in some cases disrupted markets completely. Business-2-Business (B2B) has seen a similar development, at a slower pace, but with a strong underlying tendency. Sourcing is one of the processes where the offline experience has been hard to complement, in a meaningful way, by online solutions. Until now. Overnight, Covid-19 changed, not only behaviors, but also needs, as fairs were cancelled and connections became limited. With a new generation of buyers used to online solutions this was the natural 'go-to' solution. This swift behavioral adjustment has put a constraint on a supply side comfortable with a more conservative cycle of change. This has left plenty of opportunities for flexible companies able to adjust rapidly and harness the potential of online sourcing....

090 The role of Skill Initiatives in nurturing Entrepreneurship and Sustainability in the Leather Industry

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ABSTRACT: Today, leather industry is a major industry of huge economic importance on an international scale playing a vital role in global trade and employment generation. The study examines the skill initiatives of CSIR - Central Leather Research Institute (CSIR-CLRI) as a case study and the inimitable training models offered for the national and global leather sector, catering to the skilled human resource requirements at all levels of the sector nurturing entrepreneurs internationally. More than 80% of primary, secondary and tertiary level candidates trained by CSIR-CLRI in leather, leather products and allied sciences internationally are placed every year in wage/ self-employment with around 5% of candidates taking up entrepreneurship. The skill training modules offered by the Institute are well-formulated and structured and aid in training manpower at different levels to enable them to meet the demands of technology modernization and global competitiveness via entrepreneurship as well intrapreneurship. The skill initiatives have resulted in social and economic development of the trainees. This in turn contributes to social sustainability (designing products to satisfy customer's needs and wants) and economic sustainability of the evolved entrepreneurs. The facets of energy, water and waste management and greening the areas of transport and logistics can lead to environmental sustainability in the leather industry. The study also examines how such sustainability skill requirements shall be incorporated in the current skill models to ensure environmental sustainability in the leather industry. This will in turn help in greening of tasks within the respective job roles in the leather sector thereby moving towards a greener economy.

091 TRACEABILITY OF HIDES AND SKINS: FROM FIELD TO LEATHER

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ABSTRACT: Raw material – hides and skins – traceability is a major issue for the tanning industry. CTC has developed a simple, reliable and economically viable traceability system to ensure individual traceability (each hide is trace) from raw hide to wet blue (or wet white) and even finish leather. 1. Introduction Raw material – hides and skins – traceability is a major issue for the tanning industry. Setting up a reliable, simple and economically viable traceability system provides the leather sector a necessary tool to improve the quality of leather and by the way, makes quality charters more credible. As we can see, the traceability of leathers per se is not only a tool which, rather than creating value added directly, is a prerequisite for other actions to be meaningful. There are two main goals in implementing traceability. The first, which drove this project's instigation, is to improve the quality of leather by being able to carry out corrective actions throughout the livestock farming chain, going back as far as the animal's birth. The second, which emerged from the work and results obtained by the global solution designed and implemented by CTC, is to provide reliable knowledge on the origin of leathers and therefore offer guarantees with regards to suppliers by monitoring animal welfare and environmental responsibility in farming practices and slaughterhouses. 2. Detailed description of developments This is a 10 years project with the aim of tracing each hide or skin in a simple, reliable and economically viable way. The global solution that has been designed and developed is now being industrialized. The concept requires 4 different phases.

a. Making meat traceability reliably transfer to hides on the slaughter line
b. Securing the transfer of traceabil ity from labels to the core of hides
c. Automatic reading of the marks from the tanning stage onwards
d. A centralized management system for material quality and traceability data

3. Conclusion and prospects This project conducted by CTC at the request of the French leather industry has provided the trade with various industrial tools to ensure reliable, simple and economically viable traceability. These tools are undeniably a necessary support for the implementation

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of corrective actions aimed at improving hide quality and of quality charters allowing hide supply sources to be guaranteed and secured. The implement of this solution outside France is now possible in order to provide all players with a reliable and secure technology for the traceability of raw materials, which is a crucial issue for our industries. This technology can also be applied to exotic hides in order to be able to transfer the CITES ring code to the core material, which will make it possible to remove this ring and work on the whole hide in through-feed machines.

092 Bio-deterioration and Bio-degradation of Collagen-based Culture Heritage: Parchment and Archeological Leather

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ABSTRACT: Parchment and leather are natural collagen-based polymer materials. Due to the long-term impact of burial and atmospheric environment, the main components in these cultural relics including collagen, keratin, tannin, lipids, oils and other substances have degraded or lost. Because of the deterioration of components in collagen-based materials, great changes are caused in appearance, composition and internal structure, resulting in serious damage of the collagen-contained culture relics. In this paper, the reported works on the biological damage of parchment and archeological leather were reviewed, which was specially focused on the microbial species and the aging mechanism of collagen-based materials for parchment and leather cultural relics. The characteristics of leather cultural relics at home and abroad were introduced, and the application and research progress of several materials used for the restoration and protection of leather cultural relics were analyzed. This review is expected to provide guidelines for the protection and restoration of the rotten parchment and leather, as well as the inspiration for the future research of collagen-based cultural relics.

093 Clay/polymer nanocomposites as filler materials for leather

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ABSTRACT: In the present study organoclay based acrylic polymer nanocomposites were prepared via emulsion polymerization and used as filling agent for leather. The main objective of the study is to use inexpensive clay for preparation of synthetic tanning agent (syntan) for leather processing. Prepared clay/polymer nanocomposites consisting of different weight ratios of organoclay were characterized for morphological and mechanical strength properties. The results showed that surface roughness and mechanical strength of the films increased with increasing concentration of organoclay. The particle size and zeta potential analysis reveal that the clay/polymer nanocomposites (CPNs) were electrostatically stable with particle size varying between 62 and 295 nm. The leathers treated with experimental clay-polymer nanocomposite incorporated with 5 wt% clay exhibited smooth fibrillar arrangement suggesting excellent dispersion and filling properties, thus opening new avenues for efficient leather processing. The experimental leathers also exhibited better tensile strength of 28.0 ± 0.5 N/mm2 compared to control 26.0 ± 0.5 N/mm2 and organoleptic properties such as fullness, belly filling and softness were also improved. Thus, the prepara

094 Constructing a Novel Complex Retanning System for Aldehyde-tanned Leather Based on Polyacrylic Acid and Gemini Polyurethane Surfactant

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ABSTRACT: In this study, a novel complex retanning system composed of polyacrylic acid and gemini polyurethane surfactant was constructed for aldehyde-tanned leather. In this novel complex retanning system, the gemini polyurethane surfactant with higher surface activity can promote the penetration of polyacrylic acid into the leather, and then they form composite aggregates by the intermolecular hydrogen bonding under low pH condition to exist steadily in leather. The results showed that this complex retanning system not only could endow the resultant leather with better mechanical properties, but also effectively reduce the free formaldehyde content in the resultant leather. When the total dosage of the retanning agent was 6 wt% and the pH value of retanning late stage was 4.0, the retanning effect was the best. The thickeness, elongation and tear strength of the resultant leather improved by 8.5%, 14.5% and 18.4%, respectively. Meanwhile, the formaldehyde content in the resultant leather decreased by 30.0%. This complex retanning system paves a new way to the development of the retanning agent of chrome-free tanned leather, benefiting to meet growing demands for related technologies toward eco-friendly leather manufacture.

095 Construction and performance of a multifunctional bio-inspired flexible sensor with actuation and electromagnetic shielding

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ABSTRACT: A flexible sensor is emerging for their lightweight, sensing ability, wide sensing range. But it still remains challenges, which application in multiple service environments and multifunction. Here, a hierarchically ordered structure of flexible sensor was fabricated with gelatin, Ti3C2Tx MXene and cellulose acetate via layer-by-layer assembly. The results of SEM showed that the structure with a top layer of mimicking mussel structure of Ti3C2Tx MXene, a middle layer of like neural cage network of Ti3C2Tx MXene@gelatin, and a bottom layer of Ti3C2Tx MXene@ cellulose acetate with "brick-mortar". The flexible sensor could work in air and water with the sensing property (5.6 kPa-1 and 16.5 kPa-1) normally, excellent stability (2000 cycles) and respond time (178 ms and 156 ms). In addition, it showed well electromagnetic shielding (52 dB of EMI shielding, 99.99% of shielding effectiveness) and actuation by infrared light and moisture with controlled deformation. The plant germination experiments illustrated that the flexible sensor was friendly to the environment. Moreover, the multifunctional sensor was demonstrated great applications in flexible wearable to monitor human joints and movement, intelligent switch to warning for the heavy rain and high temperatures, and protective device to protect a human body. The flexible sensor could be used in multiple service environments and apply to electronic skin and human-machine interaction.

096 Exploration on the Controlling of Molecular Weight Distribution of Collagen Hydrolysates from Cattle Hide

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ABSTRACT: The solubility and the molecular weight distribution of cattle hide collagen dissolved by alkaline and protease were investigated. The molecular weight distribution was analysed by high performance liquid chromatography. The results showed that, the cattle hide would not be dissolved when the temperature was 50 °C below though the concentrations of sodium hydroxide have been increased to 1.0 mol/L with the water ratio of 4.0 in 5 h. By raise temperature to 60 °C, the dissolution rate of cattle hide could be effectively increased to more than 95% with 0.1 mol/L sodium hydroxide. At 50 °C, the dissolution and hydrolysis of cattle hide were mainly promoted by the concentration of alkaline. More than 90% cattle hide would be dissolved in 3-5h when the concentration was raised to 0.25 mol/L. Moreover, both the molecular weight and its distribution was decreased with increase of sodium hydroxide. The molecular weight would be decreased to 5 KD (Mw) below and the distribution width was 2.0 around when the concentration was up to 0.5 mol/L. The dissolving of cattle hide would be promoted effectively by most of protease at 50 °C below. However, it seemed that the molecular weight distribution of the hydrolysates was more difficult to be adjusted.

097 Fabrication of Flexible Nanofiber Films with Hydrophobic, Self-Cleaning, High Electromagnetic Shielding Properties Based on Hydrolysate of Waste Leather Scraps

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ABSTRACT: Highly crosslinked conductive nanofiber films (HCC-NFs) have attracted more broad attentions due to its several potential critical applications. Electrospinning could be used to fabricate nanofiber films, but it falls short in creating intimate mechanical and electrical joints between adjacent nanofibers for crosslink. Herein, a novel strategy was proposed by the three-step method to produce HCC-NFs based on hydrolysate of waste leather scraps(HWLS). The high crosslinked and hydrophilicity HWLS/polyacrylonitrile(PAN) nanofiber film was prepared by electrospinning. And then it was dip-coated in a water solution of silver nanowires(AgNWs) to obtain the HWLS/PAN/AgNWs nanofiber film. Finally, Polydimethylsiloxane(PDMS) was coated on HWLS/PAN/AgNWs nanofiber film to obtain HWLS/PAN/AgNWs/PDMS film further improve the durability of materials all-weather outdoors. The Scanning Electron Microscope and Energy Dispersive Spectroscopy results showed that AgNWs were interweaved with HWLS/PAN nanofibers to form conductive networks. The conductivity and the shielding efficiency of the HWLS/PAN/AgNWs film with 160 μm thickness could reach 105 S/m and 65 dB. The HWLS/PAN/AgNWs/PDMS films had electromagnetic shielding efficiency of 80 dB and water contact angle of 135.5°. The high-performance, environmentally friendly, and low-cost EMI-shielding materials not only displayed promising potential for application in flexible shielding materials or wearable electronic equipment, but also offered a new approach toward recycling leather solid waste in a morevalue-added way.

098 Factors influencing the leather shrinkage under changing climate conditions

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ABSTRACT: The shrinkage of leather under the influence of alternate climate conditions, especially under the influence of dry heat, restricts the usability of leather e.g. in the automotive sector. Leather shrinkage can manifest itself as dimensional loss or isometric force development. The main cause of irreversible leather shrinkage is partial denaturation of the triple helix. Reversible dimensional changes occur due to adsorption and desorption of moisture under changing environmental conditions. In the present study, the influence of the crosslinking-degree of pretanning and the influence of the chemistry of retanning and fatliqouring agents on dimensional loss and the correlation to the degree of partial denaturation during different climate change tests was investigated. Furthermore, the influence of the dynamic of the climate change tests especially the relative humidity between the hot phases on irreversible an reversible dimension loss and irreversible degree of denaturation was investigated.

099 Green synthesis of zinc nanoparticles: An insight in leather nano-coating applications

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ABSTRACT: Zinc nanoparticles usage has been increasing by several industries such as cosmetics, paint, rubber and coating. Specifically zinc nanoparticles has been received great attention in the field of biological applications due to their intrinsic biocidal activity, minimal production cost, biocompatibility and less toxicity. In general, vegetable tanned finished leathers used for footwear are susceptible to microbial attack. In the present study, zinc nanoparticles has been synthesized by vegetable tannins such as, wattle and chestnut and has been used for finishing process of vegetable tanned leather. Synthesized zinc nanoparticles (ZnNPs) primarily characterized by UV-VIS spectroscopy, absorption range has been found in the range of 415-450 nm. Further purified ZnNPs has been characterized by Fourier Transform-Infrared Spectroscopy (FTIR) to identify the ascertained functional groups. Particle sizes and shapes of the Zn-NPs been found using Dynamic Light Scattering (DLS) and Scanning Electron Microscopy (SEM) which confirmed that size of all the particles are less than 100 nm and all the nanoparticles are spherical in shape. Topographical features and roughness of the ZnNPs have been measured through AFM. Antibacterial (Escherichia coli and Bacillus cerus) and antifungal activity (Aspergillus niger) of Zn-nano coated leather has been assessed. Chestnut mediated nanoparticles (C-ZnNPs) exhibits higher bactericidal activity against E. coli (20mm), Wattle mediated nanoparticles showed maximum activity against E. coli (22mm). C-ZnNPs and W-ZnNPs showed significant inhibitions as 8 and 9mm against Aspergillus niger respectively. The present study suggests that biosynthesis of zinc nanoparticles using vegetable tannins can be used as the antimicrobial agents in the finished leather and leather products.

100 Kinetics of Enzymatic Hydrolysis of Collagen Fiber with Ammonium Chloride /Neutral Protease System

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ABSTRACT: The kinetics of enzymatic hydrolysis of collagen fiber is studied using neutral protease and ammonium chloride/ neutral protease system. The structures of collagen fibers and neutral protease before and after the enzymatic hydrolysis were characterized by HR-XRD and FPA-FTIR to investigate the enzyme catalytic effect of NH4Cl/neutral protease to collagen fibers. NH4Cl/neutral protease system could accelerate the reaction between protease and collagen fibers. A simplified kinetic model for the impeded reaction is developed to describe the enzymatic hydrolysis of collagen in a complex solution system and a time-dependent decay coefficient of impeded reaction is proposed. Both the initial observed rate constants and ineffective coefficients were obtained to elucidate the interaction between neutral protease and collagen, and the applicability of the simplified model was demonstrated. A theoretical guidance is provided for the extraction and hydrolysis of collagen.

101 Leather Product Diversification by Designing and Developing Novel Innovative Multi-Functional Leather Product

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ABSTRACT: In Ethiopia, We know off today there are no leather products which have a capability to have variety of purpose through incorporating fashionable look, as far as considering the problem of disabled people, religious Muslim believers, fashion designers, and students as supporter product for exercising drawing as well and to have nap in, therefore need to diversify the leather product. This research work was aimed at product diversification by design and development of multi-functional product through descriptive research design with the approach of design portfolios development, prototype construction, existing product observation, interviewing designer at Ethiopian Leather Industry Development Institute and documents which available in. Findings of this research targeted disabled people who have not leg, students, fashion designers, Muslim peoples and car drivers. It was made from materials such as fabric, reinforcement, aluminum holder and leather in order to use as laptop case, school bag, driver car seat, Muslim matters, helping sketch pad as well. Since the impact of the multi-f unctional products on the environment is lower than in case of using single functions products to fulfill the same functions: less resources, less waste and emissions during the production and packaging, transport and distribution stages and at the product end-of life, less waste to be processed. The country will benefited from the exporting tax and create job opportunity, the company will be benefited by selling this developed leather product by good price and the costumer can be benefited by protecting their personal articles by using these comfortable durable and timelessness leather product.

Key words:

› design portfolios, development, pad, matters, holder, multi-functional, disabled

102 Mesoporous Hollow Silica Spheres Stabilized Pickering Emulsion to Improve Water Vapor Permeability and Water Resistance

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ABSTRACT: In order to solve the negative impact of coating on water vapor permeability of leather and overcome the poor water resistance of traditional polyacrylate leather finishing agent, mesoporous hollow silica spheres were proposed to improve the water vapor permeability and water resistance of polyacrylate film by Pickering emulsion polymerization. Hence, stable Pickering emulsion stabilized by mesoporous hollow silica spheres was prepared. TEM results show lots of silica spheres sit at the surface of polyacrylate latex particles, confirming the formation of Pickering emulsion. Turbiscan Lab shows that the as-obtained Pickering emulsion possesses excellent stability by hexamethyldiazosilanemodifiedmesoporous hollow silica spheres with suitable contact angleofabout37°.Ofinterest,waterabsorption measurements show that the water absorption ratio of film with mesoporous hollow silica spheres reduction of down to40.84%, possessing the ideal ability to water resistance of pol acrylate film. Meanwhile, the introdution of mesoporous hollowsilica spheres can endow the film excellent the water v porpe meability. This study canprovide a theoretical found tion fordesigning and synthesiin funtional leather finishing agent.

103 Modification of castor oil-based waterborne polyurethane with poly-hydroxy sapium sebiferum oil as crosslinking agent

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ABSTRACT: Castor oil-based waterborne polyurethane (CWPU), prepared from castor oil (CO), has been widely studied for its environmental protection. However, the low activity of secondary hydroxyl group of CO reduces crosslinking degree of CWPU, which leads to poor stability of CWPU. Sapium sebiferum oil with high iodine value contains a large number of carbon carbon double bonds. By modifying double bonds of sapium sebiferum oil, the polyhydroxyl crosslinking agent can be prepared to improve the crosslinking of CWPU. In this paper, the sapium sebiferum oil-based polyols (SOP) were prepared by thiol-ene photo-click reaction with mercaptoethanol and sapium sebiferum oil. The molecular structure and hydroxyl values of the SOPs were characterized. Then, the SOPs were introduced into CWPU to prepare modified CWPU (CWPU-SOP). The anti-graffiti properties, water contact angle, mechan ical properties and thermal properties of CWPU-SOP were tested. With the content of SOP increased, the water contact angle of CWPU-SOP film increased by nearly 20° than that of CWPU film, and it had good anti-graffiti performance, which can be erased by dry bumf without leaving trace after being written by marker. The temperature of 50% weight loss of CWPU-SOP film increased by 12℃ than CWPU and the tensile strength and elongation at break can be improved 2.2 and 2.8 times than CWPU, respectively. Those results may be related to the addition of crosslink network structure initiated by branched polyols and intermolecular hydrogen bonds between the urethane bonds. The research provides an efficient strategy for the preparation of bio-based green materials.

104 New Insight Analysis for the Application of Nanotechnology in Leather Processing Materials and Leather Products

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ABSTRACT: Now a day, the application of nanotechnology in leather production is one of the emerging technology in the world. Its role in the manufacturing area is accelerating with a positive momentum through this time. Recently, increasing interests have been directed towards the incorporation of nanotechnologies into leather manufacturing, which offers cost-effective and improvements in leather performances, as well as enabling the industry to meet legislation regarding environmental safety. Nano-level research is paving the way for leather producers to make it higher quality by improving its property and resistivity from a harsh environment. This article revealed the scenarios of nanotechnology in manufacturing sectors especially in leather and related disciplines. It also points out how scientists explore the properties of materials at the nanoscale level, which is applicable in leather or related products, and its processing until the finishing stage. The article describes the type of instruments tracing nanomaterial properties and identifying some innovative techniques until the finishing stage of leather processing to improve the functional properties of products. In this new insight, nanomaterials contributed for antibacterial, flame-retardant, and self-cleaning properties to leather and fabric are analyzed. The conventional approach is to apply such treatments directly to the leather or fabric, but thanks to nanotechnology, encapsulated products can now be applied. Finally, the study summarizes the application of nanoscale materials with properties in leather manufacturing processes, including its finishing and effluent treatments of the entire process.

105 Preparation of a waterproofing fatliquoring agent and its application on suede split bovine leather

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ABSTRACT: Water resistance is one of the most important properties of leather products, and waterproofing fatiliquoring agents have been attracted more and more attention. In this paper, a novel waterproof fatliquoring agent WR was prepared and applied in the production of suede split bovine leather. Firstly, the acrylate copolymer was synthesized by free radical copolymerization reaction using stearyl acrylate and acrylic acid as the raw materials and azodiisobutyronitrile (AIBN) as the initiator. The waterproof fatliquoring agent WR was then obtained by mixing the acrylate copolymer with polysiloxane. The structure of the copolymer was characterized by FTIR and 1H NMR. The physical and chemical properties of WR were determined, and its application properties were investigated by testing the properties of crust leater bfore and after WR treatment. It was found that WR with average particle size of 537.5 nm at pH 7 was still very stable after 6 months. The dynamic waterproofing times of the treated leather were more than 30,000 times and the static water absorption rate for 24 h was less than 35% when the dosage of WR was 10%, which could meet the commercial requirement for the waterproofing suede leather. The water contact angel of treated leather was 154.3o with a WR dosage of 15%. SEM results show that collagen fibers were better dispersed after the WR treatment.

106 Prominent Physical Characteristics of ETHIOPIAN HIGHLAND SHEEP LEATHER

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ABSTRACT: Ethiopian highland sheep leather has achieved a reputation as a glove material due to its softness and durability even if reduced in its thickness. In 2019, under the cooperation between Ethiopian Leather Industry Development Institute and Japan International Cooperation Agency (JICA), the research was implemented to identify the Ethiopian sheepskin characteristics with support from Tokyo University of Agriculture and Technology and Tokyo Metropolitan Leather Technology Center. The aim of our research is to clarify the Ethiopian highland sheep leather uniqueness. The cross-sectional structure with SEM, organoleptic properties, and physical strength of Ethiopian highland sheep leather were compared with those of the sheep leather from Indonesia and South Africa. The proportion of the papillary layer of the Ethiopian sheep leather showed 40% of the total thickness when the sample was reduced to 0.4 mm, whereas that of the Indonesian and the South African sheep leather were 100% and 60%, respectively. The tensile strength of the Ethiopian sheep leather showed twice times higher than that of the Indonesian and South African sheep leather at the same thickness. It is concluded that Ethiopian sheep leather showed remarkable strength even if shaved down to the thickness of 0.4 mm because of the greater proportion of reticular layer thickness which maintain the strength. JICA also supported Ethiopian leather product export promotion with a brand named "Ethiopian Highland Leather". The findings have been utilized to demonstrate the reasons why Ethiopian highland sheep leather was thin, soft, and strong to international buyers.

107 RESEARCHES ON THE PRODUCTION OF PARCHMENT FROM TURKEY SKIN AND ITS DECORATIVE USE

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ABSTRACT: In this study, parchment was made of waste turkey skin and some tests were done. These tests are; Determination of thickness (TS 4117 EN ISO 2589), Determination of tensile strength and elongation (TS EN ISO 3376), Determination of tear load - Part 2: (Double edge tear) (TS 4118-2 EN ISO 3377-2), Leather - of distension and strength of grain (TS 4137 EN ISO 3379), Colour fastness to water spotting (TS EN ISO 15700). Due to the low strength properties of turkey skin, a different usage area was tried to be created by making a decorative flower design. In this research, it has been tried to show how a waste material can be transformed into a product with a very high added value.

108 Spectral characterization and HPLC profiling of a novel vegetable tanning agent extracted from the stem bark of an indigenous plant Xylocarpus granatum

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ABSTRACT: Animal skins are tanned to convert into durable and flexible leather consisting of a multi-dimensional intimate structure. A chrome tanned leather shows the exceptional quality and strength properties, however, it is alarming as it could be hazardous to the environment and human health. Thus vegetable extracts from natural sources have been prioritized for the tanning process as an alternative to chrome tanning. In this research, an initiative has been made to extract vegetable tannin from the Xylocarpus granatum bark using different solvents (e.g., water, methanol, ethanol, and chloroform) and a comparison was made with conventional tanning agent mimosa and quebracho. Among them, extraction efficiency of methanol (100%) and ethanol (100%) were found to be higher and the order was: methanol (31.22%) > ethanol (30.76%) > water (10.34%) > chloroform (6.22%). Chemical tests that include FeCl3, gelatin, and FeSO4 solution test of the extracted bark sample showed green-black, white, and violet color precipitate respectively, which indicated the presence of tannin. The UV-visible and Fourier Transform Infrared spectroscopic investigations have demonstrated that Xylocarpus granatum bark contained tannins and flavonoids. High-Performance Liquid Chromatography investigation had revealed the presence of a significant amount of tannin and polyphenolic compounds, e.g. epicatechin (503 mg/100 g dry extract), catechin hydrate (218 mg/100 g dry extract), catechol (29 mg/100 g dry extract). Moreover, condensed tannins, moisture content, and pH of the extracted bark were found at 47.80%, 5.82%, and 3.82 respectively. Therefore, the extracted bark tannin could be an efficient alternative to the existing vegetable tanning materials.

109 Surface activity and wettability of surfactant mixtures of cationic hydrocarbon surfactant and nonionic fluorocarbon surfactant with two short fluoroalkyl chains

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ABSTRACT: Fluorocarbon surfactants possess superior properties, which have been used in improving the quality and performances of leather. However, owing to the high toxicity, bioaccumulation and used cost of conventional fluorocarbon surfactants, their extensive application in leather production is greatly limited. To remedy these defects, we reported a simple strategy that is mixing a cheap hydrocarbon surfactant, cetyltrimethylammonium bromide (CTAB), with an eco-friendly nonionic fluorocarbon surfactant (F9EG13F9) with two short fluoroalkyl chain. The results showed that the critical micelle concentrations of CTAB/F9EG13F9 mixtures (in the range of 0.191 to 0.314 mmol/L) were far lower than that of individual CTAB (0.429 mmol/L) and F9EG13F9 (0.408 mmol/L). Meanwhile, CTAB/F9EG13F9 mixtures could adsorb faster at air-liquid interface and solid-liquid interface, which meant the stronger surface activity and wettability compared with individual CTAB and F9EG13F9. Above findings manifested that mixing CTAB with F9EG13F9 improved the performances of F9EG13F9 and reduced its used cost, which could afford new opinions into the widespread application of fluorocarbon surfactants in leather industry.

110 The adsorption of ciprofloxacin on modified sodium alginate gel beads

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ABSTRACT: New sodium alginate porous gel beads (PAPGB) were prepared by using sodium alginate and procyanidins as raw materials and aluminum sulfate and calcium chloride as complex crosslinking agents in order to remove ciprofloxacin from water. The structure of the gel bead was characterized by infrared spectroscopy, thermogravimetric analyzer and scanning electron microscope. The effects of adsorbent dosage, pH and temperatures on the adsorption of ciprofloxacin in PAPGB were studied in details. The results show that PAPGB has a porous structure, and the removal rate of ciprofloxacin is the highest when the pH value is at 6. The adsorption thermodynamics of ciprofloxacin on PAPGB's could be described by Freundlich adsorption model well. The adsorption kinetics can be described well by the pseudo-second-order model.

111 An investigation of industrial injuries and associated factors in tannery Industries: A case of Ethio-Leather Industry PLC (ELICO) in reference to Awash and Abyssinia Tanneries

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ABSTRACT: The magnitude and severity of industrial accidents is increasing worldwide and worsen in developing nations like ours. The study aimed to assess industrial injuries and associated factors in tannery industries by referring to Awash and Abyssinia Tanneries of Ethio-Leather Industry from 2011-2012 E.C. Questionnaire, interview and observation were employed to acquire primary data and for secondary data review of relevant studies and company records were conducted. A sample of 223(44%) drawn from target population from which 208 (93%) were used. Quantitative data was analyzed through descriptive and inferential statistics and SPPS version 20.0 was used. Among respondents 65.4% sustained injury at least once. Cut, abrasion, falling, eye injury, wound and suffocation found to be major accidents. Commonly affected body parts were hands, fingers, backbone, leg, toe and knees. Slippery floors, poor layout, lifting heavy objects, unsafe tanning machineries, improper manual handling, toxic chemicals, and dust were major predisposing factors for injuries. Industrial accidents were significantly correlated with gender, educational level, work experience, work unit, PPE usage, job satisfaction and training programs. Female workers were more injured than their male counterparts. Respondents who have been working for more than 15 Years had by half less exposure to accidents than respondents with less experience. Employees working in beam house found to be more vulnerable to injuries than employees in other units. In conclusion, the company should facilitate awareness programs, PEE usage, and maintain safe work place through practicing effective accident prevention and response plan by involving all workers.

Key words:

› words: injuries, tanneries, employees, industrial, safety

112 APPLICATION OF L-ASCORBIC ACID AS AN ANTIOXIDATIVE COLORMENT IN LEATHER FINISHING

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ABSTRACT: In this study, chrome tanned bovine crust leathers were dyed white by finishing process. Experiments with 1%, 2%, 3%, 4% and 5% L-ascorbic acid addition were performed on the finishing layer of the finishing application. L-ascorbic acid was not added to the control group and processed according to the standard method. After these processes, color measurement analyzes were performed on Konica Minolta CM 3600d spectrophotometer. In order to investigate the effects of L-ascorbic acid on other performance properties of the leather, light fastness test according to TS 1008 EN ISO 105-B02 (2001 TS EN ISO 11640 2001), dry rubbing fastness test according to the standard method. The results of the analyzes were evaluated statistically.

As a result of the study, leathers have seen powder color with L-askorbic acid. It was observed that L-ascorbic acid improved dry rub fastness. In the light fastness tests, the results of the experimental group experiments were recorded better when compared to the blue scale.

113 Fabricating industrially viable biocatalysts from fungal origin, isolated from leather scraps : A scheme to bring about a revolution in Leather industries

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ABSTRACT: Current scenarios claim a more sustainable, ecofriendly and cost-effective dealings worldwide to deal with the growing troubles of environmental issues. The main aim of this endeavor is to opt for path-breaking and novel ideas and technologies which involve cleaner and greener procedures for utilizing waste leather samples for deriving value added products that can be employed for leather processing itself. The waste leather samples contain dense population of various microbes', especially of fungal origin. When this leather samples are kept under moist and damp conditions for prolonged period of time., ample amount of growth of fungal colonies occur on its surface . This occurs basically due to the ideal conditions of the damp environment along with the leather samples which present a great harboring ground for fungal origins. These microbes are rich in lipase as well as protease content. Firstly, we isolated fungal colonies from this leather source and fermented them under various conditions to extract fungal enzymes i.e. lipase as well as protease .and then used it for further analyses. These enzymes are highly versatile and industrially vital. Procuring these enzymes from waste leather samples is the main appeal .

114 foot model reconstruction via a 3D structured light truedepth camera

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ABSTRACT: There are a number of laser or structured light based foot scanners available on the market, which can be used to obtain accurate 3D foot models. However, these devices are generally complex in construction and expensive. Compared to those 3D scanning devices, truedepth cameras are portable , inexpensive and easy-to-use,but the accuracy of their 3D foot scanning remains to be confirmed.This study aimed to propose a mobile 3Dfoot scanning protocol based on structured light truedepth camera and contrast with infoot 3D foot scanner to verify its measurement accuracy .Therefore,thirteen students without any kinds of foot abnormalities or foot diseases were recruited for experiment and their feet were measured by infoot 3D foot scanner and app.Three parameters were measured including foot length,foot width and Ball girth.After that, linear regression analyses and Bland-Altman analysis were conducted and Intraclass Correlation Coefficient was calculated by SPSS23 , which showed large correlation coefficients (R>0.9，large coefficients of determination (R2>0.8)and excellent agreements(ICCs>0.9)among the two measurements methods. The findings from Bland-Altman analysis demonstrated that the measurements from APP scanner were high-correlated with those from professional instruments, even with exception of foot length. Overall, the APP scanner showed well reliability and accuracy and it is a quick and convenient method to obtain the foot 3D model.

115 OBTAINING OF PROTEIN SUBSTANCES FROM LEATHER INDUSTRY SOLID WASTES

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ABSTRACT: Proteins are valuable food source used by all living things such as humans, animals, plants and microorganisms to perform their cellular and vital activities. However, an estimated one billion people worldwide suffer from many diseases due to protein deficiency. This problem is mainly due to the fact that 30% of children in Central Africa and South Asia consume small amounts of protein. Due to protein deficiency, various diseases such as growth delay, edema, liver failure, skin, hair, nail and hair problems occur in humans, and plants and animals are also unhealthy and inefficient. For this reason, it is necessary to prevent these problems by taking supplemental proteins. However, this process is limited due to factors such as shortage of protein source and uneconomical production. The leather industry is an industrial area that is known for its pollution due to the wastes generated as a result of production and tries to continue its production despite criticism. However, 3 types of leather waste, such as tanned, untanned leather and wool wastes, are recyclable due to they have a high protein content. It is possible to obtain very valuable animal-based proteins called collagen from tanned, untanned leather and keratin, from wool wastes. In this study, in addition to reducing the environmental burden by using leather waste as a raw material in order to eliminate the aforementioned protein deficiencies, it will also focus on cheap and effective protein production for a scarce protein source in terms of circular economy.

WLC

World Leather Congress (WLC); The leather industry has recently been experiencing a technological and digital transformation, by developing and implementing new organization patterns.This transition has gone hand to hand with the industry's commitment to safeguard and keep intact the story, cultural relevance, significance, sustainability, and properties of "leather".

After the meetings held in South America (Rio de Janeiro, 2011), Europe (Milan, 2015), Asia (Shanghai, 2017), and America (New York, 2019), the 5th World Leather Congress strengthens its global vocation by reaching the African Continent; the 5th WLC is being held on 1st Nov 2021 in Addis Ababa, Ethiopia.

The WLC is organized by the International Council of Tanners (ICT) in collaboration with Member Association.

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Africa Leather and Leather Products Institute - ALLPI

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History

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1987 Melbourne -. Australia
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1993 Porto Allegre – Brasil
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2001 Cape Town – South Africa
2003 Cancun – Mexico
2005 Florence – Italy
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