

Recent Environmental Regulations and Technical Developments in World Leather Sector

Dr. S. Rajamani⁽¹⁾ - Dr. Volkan Candar⁽²⁾



⁽¹⁾ Chairman - International Union of Environment Commission of IULTCS,
Old No.18, New No.45, First Street, South Beach Avenue, M.R.C. Nagar,
Chennai – 600 028, India. Mobile : +91 9840063210

Email : dr.s.rajamani@gmail.com

⁽²⁾ President - International Union of Environment Commission of IULTCS
DETEK, Organize Deri Sanayi Bolgesi, 18 No'lu Yol, 34957, Tuzla, Istanbul,
TURKEY, Tel: +90 262 6754403 / Fax: +90 262 6754210

Email : acandar@pulcrachem.com



Abstract

International Union of Environment (IUE) Commission of IULTCS has got 40 technical members from all major Leather producing countries, UNIDO and European Union (EU). The recent environmental regulations and systems developed in world leather sector with specific reference to Asian Countries including India, China etc. are dealt in this technical paper.

Annual world leather process is estimated at 15 million tons of hides and skins. Wastewater discharge from tanneries is more than 600 million m³/ annum and solid waste generation is about 6 million tons/year. The safe disposal of sludge which is about 5 million tons/year from effluent treatment plants is one of the major unresolved issues in many countries. The leather production activities, especially raw to semi finishing processes are being shifted from United States, West European countries etc. to Asian and South American countries.

Environmental regulations and standards are similar in developing and developed countries. Certain parameters are more stringent in developing countries when compared to the developed countries. Major investments are being made for the environmental systems and resettlement of tanneries from the urban areas to the industrial parks. New regulations such as restriction on the use of chemicals, control on salinity and water recovery under Zero Discharge Concept, Management of chromium containing sludge etc. envisage continued Research & Development activity.

Key words : IUE Commission, Environment, World Leather.

1. Introduction

The International Union of Environment IUE Commission is a vibrant wing of IULTCS with about 40 technical members from 32 countries and invitees from United Nations Industrial Organization (UNIDO), European Union (EU) and other relevant international organizations. The IUE Commission regularly meets every year in one of the

member countries and update the development. The meeting for the year 2011 was held during September 2011 in Valencia, Spain. The meetings for the year 2012 were held in Montevideo, Uruguay during October 2012 along with Latin American Congress (FLAQ TIC 2012) and Taiwan, Taipei during November 2012 along with 9th Asian International Congress (AICLST). The lists of IUE members are given in Table-1.



Fig.1 : Participants of IUE Commission Meeting held on 10th October 2012 at Montevideo, Uruguay

Table 1 - Members of IUE Commission

S. No.	Country	Representatives
1.	Argentina	Dr. Patricia Casey, Vice President, IULTCS
2.	Australia	Ms. Catherine Money
3.	Austria	Dr. Hans Andres
4.	Brazil	Prof. Dr. Mariliz Gutterres, Mr.Roberto Kamelman, Dr.Regina Cánovas Teixeira
5.	China	Mr. Chen Zhanguang, Mr Su Chaoying, Dr. Shi Bi
6.	Colombia	Mr. Juan Manuel Salazar
7.	Croatia	Mr. Jakov Buljan
8.	Czech republic	Prof. Dr. Karel Kolomaznik
9.	Denmark	Mr. Johannes O. Borge
10.	European Union	Mr. Gustavo Gonzalez
11.	France	Mr. Thierry Poncet, Secretary, IUE
12.	Germany	Dr. Dietrich Tegtmeier, Chairman, IUR
13.	India	Dr. S. Rajamani, Chairman, IUE & Mr.Arnab Jah
14.	Indonesia	Ms. Suliestiyah Wiryodiningrat
15.	Italy	Dr. Gianluigi Calvanese
16.	International Tanners Council	Mr. Paul Pearson
17.	Japan	Dr. Keiji Yoshimura
18.	Mexico	Mr. Ricardo Weiss
19.	New Zealand	Ms. Ngaire Foster
20.	Poland	Dr. Maciej Urbaniak
21.	Portugal	Mr. Filipe Crispim
22.	Romania	Dr. Luminita Albu / Dr.Loannis Loannidis

S. No.	Country	Representatives
23.	Slovenia	Dr. Anton Gantar
24.	Spain	Dr. Rita Puig
25.	Switzerland	Dr. Campbell Page / Dr Jens Fennen
26.	The Netherlands	Mr. Arnold Mulder
27.	Taiwan	Mr. George Huang / Mr.Thomas Yu
28.	Tunisia	Dr. Abdessatar Toumi
29.	Turkey	Dr. Volkan Candar, President, IULTCS / Prof. Dr. Altan Afsar
30.	UNIDO, Vienna	Mr. Ivan Kral
31.	United Kingdom	Dr. Wolfram Scholz / Ms.Christine Ohren-Bird
32.	United States	Mr. Elton Hurlow / Mr.Mainul Haque
33.	Uruguay	Mr. Ricardo Hourdebaigt

2. Waste Discharges and Environmental Management

The wastewater discharge from world tannery sector is more than 600 million m³/year. The estimated solid waste generation from tannery process is about 6 million tons/year. The disposal of large quantity of sludge which is about 5 million tons/year from effluent treatment plants is one of the major unresolved issues in many countries.

The IUE commission has developed essential guidelines and practices adopted in cleaner production, treatment of effluent, solid waste management and environmental regulations. The updated IUE documents with number and title are given in Table – 2.

Table 2 - IUE Commission Documents

S. No.	Doc. No.	Title
1.	IUE 1	Recommendations on cleaner technologies for leather production
2.	IUE 2	Recommendations for tannery solid by-product management
3.	IUE 3	Document on total dissolved solids in tannery effluent
4.	IUE 4	Assessment for chromium containing waste
5.	IUE 5	Typical performance for tannery wastewater treatment
6.	IUE 6	Typical pollution values related to tannery processes
7.	IUE 7	Chargeable effluent parameters in various countries
8.	IUE 8	Recommendations for odour control in tannery
9.	IUE 9	Recommendations for sewer adapted for tannery effluents
10.	IUE 10	Guidelines for restricted products in leather
11.	IUE 11	Recommendations for occupational safety and health aspects
12.	IUE 12	Concept and Guidelines for Environmental Footprint for Leather Sector

3. Environmental Updates

Almost all the leather processing countries including Asian and African countries have introduced pollution control standards similar to the standards adopted in United States, European Union and other developed countries. Due to serious environmental issues, cleaner production and implementation of Common Effluent Treatment Plants (CETPs) in tannery

clusters, relocation and resettlement of tanneries from urban towns to designated industrial areas had been done in countries such as Spain, Turkey, India, China etc. with major investments. Many countries such as Bangladesh, Egypt etc. have planned to relocate the cluster of tanneries from the cities to new industrial zones with CETPs. In many countries including in India new tanneries or expansion of the existing tanneries are permitted only in authorized industrial parks with Common Effluent Treatment Plants (CETPs).

The sustainability of the small-scale units has become a serious issue in leather sector due to enforcement of environmental regulation in many countries 400 small-scale tannery units have been closed in China during 2007 to 2009. Currently environment is the major area of research carried out by the leather research institutes and universities. More than 50% of the research publications in the world leather sector deal with cleaner production & waste management.



Fig.2 : Submerged Membrane Bioreactor plant in Simona Tanning
for water recovery - CHINA

With a view to control salinity and environmental protection in countries such as Brazil the hides and skins from the slaughter house needs to be processed immediately without preservation using common salt. During the International recession period there was no demand for the wet blue/finished leather, and the disposal of unsalted hides and skins had become a major environmental issue in Brazil. Currently the organized slaughter houses in Brazil and other countries are building their own tanneries to process fresh hides and skins without applying salt for preservation. Management of high chlorides and salinity in the tannery effluent has become a serious environmental threat in many countries including Spain, India & China etc. They have started adopting membrane system for water recovery and costly treatment of the saline rejects from the membrane system.



Fig.3 : Total biological treatment system without chemical use – ITALY


The recent developments in cleaner production and waste management in selected leather producing countries are given in Table 3.

Table 3 - Recent Developments in Environmental Protection

S. No.	Country	Recent Developments
1.	ARGENTINA	<p>During the recent years the per capita meat consumption fell to the lowest level in the last 50 years and was about 53 kg/inhabitant as per 2011 data. There are 8 big tanneries, about 40-50 medium and small lines are existing in Argentina. In addition, there are about 70 workshops producing leather and splits in different stages. The wastewater discharge from Argentinean tanneries is about 10 million m³.</p> <p>The environmental regulations and pollution control standards adopted in Argentina are similar to the standards adopted in the United States, European Union and other developed countries.</p> <p>Some tanneries implemented an Environmental Management System certified according to ISO 14001. Some tanneries also have been audited by LWG. In some cases the demands of NGO's such as Green Peace have generated advances in the implementation of practices required by the norms in force. Cleaner production processes such as processing of fresh hides, green fleshing and fat recovery to produce industrial tallow, lime splitting, unhairing with hair recovery are commonly adopted in individual tanneries.</p>



Fig.4 : “Green Peace” Argentina – Environmental Targets for Tanneries

S. No.	Country	Recent Developments
2.	BRAZIL	<p>The per capita meat consumption of Brazil is more than 35 kg/year. Brazilian bovine leather which constitutes around 12.5% in the world share. Brazil has 749 tanneries and other leather processing plants mainly located in Rio Grande do Sul and São Paulo States. Brazil is the third largest producer and exporter of leather in the world.</p> <p>The current laws in Brazil relating to effluent control are Resolution CONAMA 357/2005 (which classifies water bodies, offers environment guidelines, and establishes the conditions and standards for effluent discharge and other steps) and Resolution CONSEMA N° 128/2006 (which sets emission standards for the discharge of liquid effluent to superficial waters in the Rio Grande do Sul). The new regulation Resolution CONSEMA N° 129/2006 about toxicity monitoring and control have been introduced in Brazil (Cooper <i>et al.</i> 2011).</p>
		
<p>Fig.5 : Effluent Treatment Plant in a Tannery - Brazil</p>		
3.		<p>Photo-Electro Oxidation and electro dialysis for water recovery and reuse are the R&D activities in the Federal University of Rio Grande do Sul and SENAI Leather Center. Controlled incineration of chromium tanned wastes and development of constructed wetlands for effluent treatment in some tanneries at pilot scale are some of the recent field applications. Meeting toxicity standards, restriction in the disposal of chrome containing sludge even in common secure land fill site are some of the recent challenges.</p>
4.	CHINA	<p>Currently there are about 800 tanneries. Till now, about 12 CETPs are in operation, Some more are under planning. Planned to reduce volume by 10% and pollution load at source. The tanneries are permitted to expand the capacity without increase in the water usage. One of the major tanneries has implemented the MBR and RO system for water recovery and reuse. As such there is no specific restriction on the Total Dissolved Solids (TDS) or salinity norms for the disposal of treated effluent. However meeting the BOD, COD norms for the saline streams from RO is one of the issues to be addressed. As a sustainability measure new</p>

S. No.	Country	Recent Developments
		license are given to tanneries with process of capacity of more than 3000 tons /year.
5.	COLOMBIA	<p>In view of the serious environmental issues, cleaner production, implementation and maintenance of Effluent Treatment Plants have become necessary in all the tanneries in Colombia. During the recent years, there had been many changes in the regulations related to environmental impacts for the general industry in Colombia. Those changes are related to waste water discharges and now the latest addition is odour control.</p> <p>Achieving some of the proposed limits such as NTK, Chloride, Sulphates are not viable in the traditional process of salted hides with conventional chemicals in the tanning operations.</p>
6.	FRANCE	Tallow extracted from fleshing converted into alternative energy source, Reed bed system is installed for effluent treatment.
7.	INDIA	<p>There are about 2000 tanneries in India. Most of them are in small and medium scale sector located in clusters. There are 19 CETPs (14 in Tamilnadu State, one major CETP in Kolkatta Leather Complex, 3 in Uttarpradesh State and one in Jalandar, Punjab State).</p> <p>It is planned to establish a biggest CETP in Asia in Kanpur city in Uttarpradesh state with a capacity of 48,000 m³/day (48 MLD) for 450 tanneries with a budget of about 60 million USD.</p> <p>Zero Liquid Discharge concepts by adopting membrane system for recovery of water from tannery effluent have been implemented in the South Indian tanneries at a cost of about 100 million USD. Decentralized secure landfill system linked with CETPs for leather sector had been implemented in many tannery clusters. (First of its kind in the world). R&D activities on bio processing are under progress.</p> <p>A new Cleaner Production Project under TDS management (viz. Improved Chromium Recovery System integrated with Water Recovery for Reuse in Tanneries Under Zero Discharge Concepts) is being implemented by</p>



Fig.6 : Biggest CETP in Asia – Under implementation - Kanpur, India.

S. No.	Country	Recent Developments
		adopting different types of membranes with the support of Ministry of Environmental and Forests (MOEF).
8.	NEW ZEALAND	Enzymes and unhairing process is becoming more popular. Elimination of salting of skins by introducing chilling process in selected areas, Sulphide oxidation, pH & settleable solids control and discharge of effluent into public sewer system.
9.	POLAND	Processing of organic materials and converting into fuel called as bio-coal, Co-fermentation of chromium-free tannery wastes with municipal sewage sludge and conversion into fertilizer.
10.	ROMANIA	Cleaner Production programmes are being carried out with the co-operation of INCDTP / ICPI, Institutions COTANCE etc. in Romania.
11.	SPAIN	<p>The CETP in Igualada with a capacity of 9 MLD has been established with a capital cost of 13 million Euro. Under utilization of the CETP, high operation costs and disposal of hazardous category sludge are some of the issues to be addressed. Membrane Bio Reactor with Reverse Osmosis (RO) for water recovery has been established in a CETP near Lorca. The water recovery system from a tannery CETP is first of its kind in the world and was commissioned during 2004-2005. The system has faced with some technical and economical issues in saline water evaporation system in the landlocked area.</p> <p>R & D activities on cleaner production and waste minimization are being carried out by the institutions in Spain: INESCOP, AIICA and EEI (Universitat Politecnica de Catalunya)</p>
12.	TAIWAN	Currently there are about 50 tanneries in operation in Taiwan. The tanneries are having individual treatment plants with capacities ranging from 300m ³ –2000m ³ /day. They adopt conventional physio-chemical and biological treatment systems.
13.	TUNISIA	Integrated cleaner production programme has been carried out for 12 vegetable tanneries in Tunisia, Research & Development on solid sludge is under progress in co-operation with CTC.

S. No.	Country	Recent Developments
14.	TURKEY	<p data-bbox="815 338 1394 501">There are about 540 tanneries existing in 14 zones viz. Tuzla(51), İzmir(24), Çorlu(78), Gereede(120), Bursa(20), Uşak(26), Gönen(18), Manisa(30), Biga(13), Denizli(20), Isparta(23), Bor(75), G.Antep(10) and Antakya(33).</p> <p data-bbox="815 539 1394 770">Eight Common Effluent Treatment Plants (CETPs) have been established and are in operation. The biggest CETP with a capacity of 36000m³/day has been established in Tuzla Industrial estate near Istanbul. The other CETPs are having capacities ranging from 1800m³/day to 36000m³/day.</p> <p data-bbox="815 786 1394 913">The tanneries had been resettled in industrial zones. R&D activities on cleaner production and environmental protection are being continued in universities such as Ege University, Izmir etc.</p> <p data-bbox="815 936 1394 996">Sludge disposal is a major problem similar to other countries.</p>
15.	UNITED KINGDOM	<p data-bbox="815 1010 1394 1173">Bio-diesel from tallow, Bio-ethanol from proteinised wastes; short-term preservation of raw hides; technical assistance on cleaner production; adoption of membrane system etc. to other countries.</p>
16.	URUGUAY	<p data-bbox="815 1182 1394 1442">Uruguay is one of the highest bovine per capita meat consumption countries. As per 2011 data the average meat consumption per inhabitant was 60.6 kg per year. Slaughtering of bovine animal is around 2.4 million per year. Approximately 600,000 pieces of raw hides and wet blue are imported in addition to 400,000 pieces of semi finished hides.</p> <p data-bbox="815 1473 1394 1771">There are about 23 working tanneries in Uruguay. Two of them are bigger ones and about six of them are medium scale units. The big and some of the medium tanneries have effluent treatment plants and they have also specific secure landfill places to dispose the solid wastes. Many cleaner production projects are being carried out with the involvement of several organizations.</p> <p data-bbox="815 1794 1394 1921">Currently, the main environmental problem to be addressed in Uruguay is the disposal of solid waste generated by the tanneries located on the Southern part of the country.</p>



Fig.7 : CETP in Istanbul (Tuzla), Turkey with sea discharge

4. Environmental Challenges & Sustainability

The leather production activities especially raw to semi-finished leather are being shifted from the developed nations such as United States, West European countries, to North African, Asian and Latin American countries. The major leather producing countries such as China, Italy, India etc. are facing problems due to enforcement of stringent regulations. The sustainability of the small-scale units is becoming a serious issue to meet the environmental requirements. Major investment is being made for environmental protection and resettlement of tanneries from the urban areas to the industrial parks with common effluent treatment plants. New regulations such as ban on use of certain chemicals, salinity and water recovery under zero discharge concept, disposal/ management of chromium containing sludge etc. envisage continued research & development activity. Innovative tanning processes which will greatly reduce the water usage are needed together with reduction of chromium and other chemicals use.



Fig.6 : SPAIN - New CETP in IUGALADA



Fig.7 : CETP with R.O system in LURCA

5. Acknowledgement

The contributions of IUE members listed in Table 1 from all the countries, UNIDO and European Union are acknowledged. Special efforts and inputs from Mr. Ivan Kral, UNIDO, Mr.Thierry PONCET, Ms.Catherine MONEY, Dr.Patricia CASEY, Prof. Dr. Mariliz Gutterres, Mr.Roberto Kamelman, Dr.Regina Cánovas Teixeira, Mr.Chen ZHANGUANG, Madam ZHANG SHUHUA, Mr.Su CHAOYING, Dr. Dietrich Tegtmeier, Dr. Campbell page, Dr.Volkan Candar, Mr.Jakov BULJAN, Dr.Wolfram SCHOLZ, Mr.Elton Hurlow and Dr. Shi Bi technical committee members of IULTCS are greatly acknowledged.

The support of Leather Research Institute by name “Asociación Española de las Industrias del Curtido y Anexas (AIICA)” located in Igualada, particularly by Dr.Agusti Marshal, Dr.Ms.Luisa F. Cabeza and Mr. Daniel Sanchez Esteve from Spanish Leather Chemists Association are greatly acknowledged.

The support of UNIDO Leather Unit, Vienna, Central Leather Research Institute (CLRI), India, China Leather Industry Association (CLIA), Taiwanese Leather Industry Association (TLIA), Indian Leather Technology Association (ILTA), Latin American Congress Federation of Leather Industry Chemists and Technicians (FLAQITC 2012) are acknowledged.

6. References

1. Minutes of the IUE Commission meetings held during September 2011 in Valencia, Spain; october 2012 in Montevideo, Uruguay & November 2012 in Taiwan, Taipei.
2. Dr.S.Rajamani & Dr.Patricia Casey, April 2010, Environmental update in Leather Producing Countries – Argentina, Leather News India.
3. Dr.S.Rajamani, Mr. Chen Zhanguang, Mr.Zhang Shuhua, Mr.Su Chaoying, May 2010, Environmental Update in Leather Producing Countries – China, Leather News India.
4. Dr.S.Rajamani, May 2011, Leather Industry and Environmental updates in Taiwan, Leather News India.
5. IUE Commission Documents, December 2012, Recent Developments in Cleaner Production and Environment Protection in World Leather Sector.
6. Dr.S.Rajamani, Dr.Patricia Casey, Mr.A.JuanManuel Salazar, Dr. Mariliz Gutterres, October 2012, Environmental Challenges in Latin American Leather Industry, XVIII Latin American Congress (FLAQITC 2012), Montevideo, Uruguay.
7. Proceedings of UNIDO Leather Panel meeting, August 2012, Shanghai, China.