Solid leather waste for preparation of value added composite products:- an Ethiopian perspective

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INTRODUCTION

- The solid wastes generated during leather processing are significant since leather industry makes uses of only 20 -25 % of the raw material in the finished leather, 75 -80 % end up as wastes in the environment (Page,2005).
- To reduce these threats, preparation of composite materials with better mechanical properties and agreeable use is a need of the time for the reason that it is eco-friendly (Teklay *et al*, 2017).

The objective :

- To prepare value added composite products fit for economic use

ABSTRACT

- *Solid wastes if not managed wisely & properly impose environmental and societal health problems.*
- *In all of composites prepared, 40 percent sisal using resin binder and polyurethane binder, 30 percent sisal using natural rubber latex had optimum results in their tensile strength (Mpa) as major parameter.*
- *These prepared composites can be used as raw materials for preparation of different items. By preparing such value added composites, we can reduce solid waste; minimize environmental pollution & thereby securing environmental sustainability and/or can be used as income generation and employment opportunity.*

MATERIALS AND METHODS

Materials

- Finished leather scraps.
- Synthetic resin,
- Polyurethane and
- Natural rubber latex,
- Polyethylene glycol
- $Al_2(SO_4)$.
- sisal (Agave sisalana)

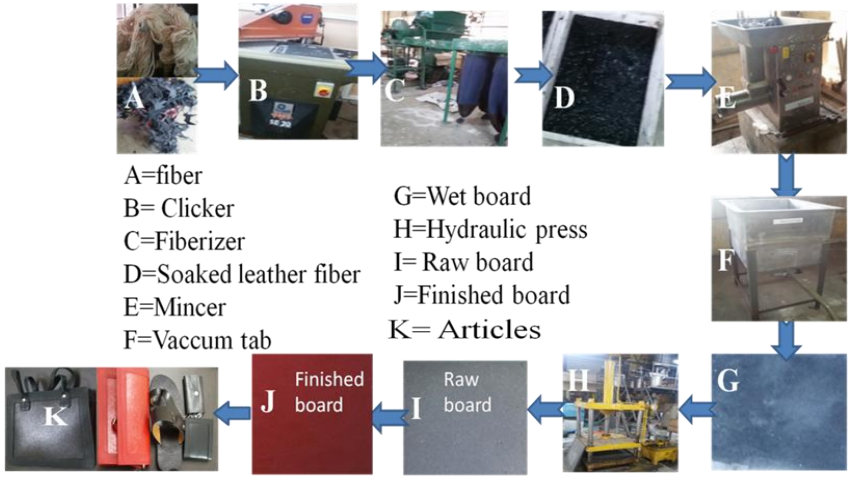
Methods

- Fiberizing of (LF)s & (PFs) to (length 5–10 cm & width 2–3 cm) using Swing ARM Clicker was done using Hinged Hammer Pulverizing machine .
- Optimizing RB, PUB & NRL) at different levels of (30, 60, 90, 120 and 150 ml with the optimum of 120 ml v/v and tested for their tensile strength.

Composites preparation

- About 130 g of fiberized leather fiber soaked in 1000 ml of water for 12 h,
- Minced in the food mincing machine to reduce the particle size and made into fine paste.
- To this paste 120 ml of RB, 10 ml of PEG and 4% of $Al_2(SO_4)_3$ was added and mixed thoroughly.
- Later, 10 ml of 1:3 ratio diluted H_2SO_4 is added and pH adjusted to below 5 by thorough mixing, the mixture was diluted using 4000 ml water so that slurry was formed.
- Then the sample was poured into the sheet making machine of (30 cm by 30 cm) and wet composite was pressed using hydraulic press at a pressure of 217.5 kPa for 10s.
- The pressed composite was air dried and plated using hydraulic press at a pressure of 13,789 kPa at 80^{0}C for 10s.

Process flow of board composite board making



RESULTS AND DISCUSSION

Mechanical properties of composites

❑In the composite products prepared using synthetic resin binder, the tensile strength values of 30 and 40 present sisal (8.57±0.85 MPa and 9.08±0.91 MPa respectively) have greater values than the control (6.05±0.57MPa) and these results are better than the results of the same author done in (Teklay et al., 2017) which was (3.39 ± 0.49 MPa) for sisal at 10 percent using NRL.

❑ In this result the better value in tensile strength of the composites than the control might be attributed to the fiber. The tensile strength values of all the composites except the one prepared at 10 percent PUB (3.71±0.91 MPa) in this study did meet the required standard set by Central Leather Research Institute shoe design and development center (CLRI-SDDC) (4.0–7.0 MPa) for the insole/shank board of footwear as per the SATRA TM2: 1995 test method because their value is in the range of (4.59±0.70-9.09±0.16 MPa).

❑In the composites prepared using polyurethane binder (PUB), the tensile strength values of the composites were evaluated.

❑In these 40 percent and 30 percent composites have better values (8.02±1.62 MPa and 6.45±0.78 MPa respectively)than their control (6.25±0.24 MPa),while the 10 percent and 20 percent composites have lower values(4.59±0.70 MPa and 3.71±0.91 MPa respectively) than their control(6.25±0.24 MPa).

❑composites were lower than the value of their control (9.43±2.74 MPa) with the optimum result being at 30 percent sisal composite (9.09±0.16 MPa) followed by the 40 percent composite (7.81±1.17 MPa) though lower than their control (9.43±2.74 MPa) very attractive results that can be used for the preparation of high quality shoe raw materials

CONCLUSION AND RECOMMENDATION

❑Therefore, based on these results, it is concluded that, composites prepared in this study are of good mechanical property

❑can be used as raw material for the preparation of light consumer goods such as chappel, high quality shoe inners, light hand bags, wallets, mouse pads, false roofing, wall partitioning, components of furniture and interior decorations.

❑ Among the different composites the optimum results of all binders 40 percent sisal in RB and PUB but 30 percent in NRL were taken as best results.

❑When we see the binder comparison those products prepared using NRL binder are better in all parameters than those prepared using RB and PUB and this can be preferred than others.

❑As a recommendation, the solid leather waste/composite preparation and utilizing it for various economic benefits in Ethiopia are untapped that calls for further study to be conducted for more exploration.

❑ Since we observed variation in strength of the products in different ratio and different binder's the author recommend that if future work is conducted in different mechanism with different binder's ratios, there might occur a possibility to improve the limitation and obtain better results.

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