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USING EXTRACTED FAT FROM COWHIDE FLESHINGS IN TANNERY FOR SOAP PRODUCTION

Md. AbulHashem[1,*] and Md. Shahruk Nur-A-Tomal[2]

[1-2]Department of Leather Engineering, Khulna University of Engineering & Technology (KUET), Khulna-9203, Bangladesh
[1,*]mahashem96@yahoo.com and [2]shahruktomal2010@yahoo.com

Abstract*-In tannery at beamhouse, during fleshing operation substantial amount of inevitable solid waste (termed as fleshings) is produced. The produced huge amount of fleshings' does not get proper utilization converselyit is discharged indiscriminately in the industrial area as green causing negative effect on the environment. The fleshings'contains 4-18% fat, which could be a great source for the byproduct production In this work, fat was extracted from the delimed cowhide fleshings with Soxhlet extractor, ethanol as solvent The extracted fat was treated with NaOH on hotplate stirrer. After completing saponification, the soap solution was poured into saturated NaCl where soap was coagulated. The soap was then filtered and rinsed with ice water to remove excess NaOH. Then the soap was dried and allowed to cure for several days. The soap was milky white in color with pH 8-9 and soluble in distilled water. The soap has good lathering and cleansing power. The process could be optimized for large-scale production, which will be allowed to produce a new product for the commercial use.*

Keywords: Tannery solid waste, Fleshings, Soxhlet extractor, Fat and Soap

1. INTRODUCTION

Tannery is an export-oriented sector of Bangladesh, which plays an important role in the national economy. According to the Export Promotion Bureau (EPB), leather sector contributed US$1.29 billion to the national economy by exporting leather, leather products and footwear in the fiscal year of 2013-14 [1]. The number employs of the sector (directly and indirectly) is about 0.8 million [2].

Owing to producing environmental pollutants in the form of solid, liquid and gaseous leather industry of Bangladesh is facing a great challenge to survive. The tanneries of Bangladesh produce daily 100 tons of solid waste in the form of trimmings of finished leathers, shaving dust, hairs, and trimmed animal flesh skin/hide to contaminate the soil and water [3]. The produced huge amounts of the solid wastes are discharged indiscriminately inside or outside of the industrial area without any treatment [4].

The hide/skin, byproduct from the meat industry, is the basic raw material for the tannery. In tannery, the process of tanning makes it something special and noble. Tanning is a complex procedure where involves various chemical and mechanical operations. In leather processing, from every 1000 kg raw hide/skin only 150 kg is obtained as leather and nearly 850 kg is generated as solid wastes [5].Most of the solid wastes are generated in the beamhouse operations especially in fleshing operation generates inevitable solid waste.

Fig.1: Fleshings in wheelbarrow inside the tannery

Fleshings' is the first and mostly generated inevitable solid waste at beamhouse in the tannery(Fig. 1).In leather processing, just after unhairing and liming (commonly known as liming) pelt has to pass through an operation known as fleshing. The operation involves cutting or removing the unwanted part from the flesh side of pelt. Fleshing is one of the most indispensable mechanical operations in the tannery where a substantial amount of solid waste is produced. In Bangladesh, yearly 10.3×10^3 MT fleshings are generated only from the wet salted cowhide during the fleshing operation [6]. Skipping fleshing operation would be inhibited the diffusion of tanning agents and other chemicals into the pelt from the flesh side. As a result, chemicals will be wastage and

quality leather will not be produced. However, the produced huge amount of fleshings' does not get any proper utilization conversely it is kept indiscriminately inside or outside the industrial area as green[6].The dumped fleshings' outside the tannery area is shown in Fig. 2.

Fig.2: Dumped fleshings outside the tannery

Fleshings' contains protein (5-7%),fat (4-18%), sulphide (2-4%) etc.[7].It has negative effect on the environment including human health, air, water and soil. Disposal of fleshings is also troublesome and costly. Fleshings' contains considerable amount of fat but these wastes do not get any important utilization [8]. Due to containing huge amount of fat it could be a great source of fat for the soap production.

In this study an attempt was made to extract fat from the cowhide fleshings from the tannery with Soxhlet extractor, ethanol as solvent and the extracted fat was utilized for the soap production. The initiative could be reduced pollution load caused by the tannery and more commercially usable products could be obtained.

2. MATERIALS AND METHODS

2.1 Theory of soap preparation

Soap is water-soluble alkali (sodium or potassium) salts of fatty acids, which is mainly used as surfactants for washing, bathing, and cleaning in households as well as industries. Soap is made from the fats and oils, or their fatty acids, by chemically treating it with a strong alkali according to the reaction:

Fats or oils+ Alkali + Water →Soap + Glycerin

Chemically treatment of the fats or oils with the strong bases such as caustic soda (NaOH) or caustic potash (KOH) causes them to undergo hydrolysis (saponification) to form glycerin and salt of along-chain fatty acid (soap). The nature of triglycerides and fatty acids plays abasic role for the performance and features of soap. The most common triglycerides are used for the soap preparationoriginated from animal (fats of tallow, lard, etc.) and plant or vegetable source (oils of coconut, palm kernel, olive, etc.)[9].

2.2 Sampling

Just after fleshing operation, the cowhide fleshings' was collected into polyethylene bag from the SAF Leather Industries Ltd., Khulna, Bangladesh and brought back to the laboratory immediately.

2.3 Reagents and chemicals

Various reagents and chemicals were used for making soap from the fleshings, which is generally used in the tannery. Boric acid (commercial grade), hydrochloric acid (commercial grade), ethanol (Merck KGaA, Germany), sodium hydroxide (HACH, USA) and sodium chloride (edible) were used to obtain different action.

2.4 Deliming of Fleshings

The collected fleshings' was washed with water to remove unbound lime then it was cut into small pieces to facilitate the next operation. Then the fleshings' was delimed with 2% (w/w) boric acid and 60% water for about 5-6 hours to remove the lime. The pH of delimed fleshings was adjusted to 6-7 by treating with dilute hydrochloric acid. The fleshings were further washed with water. The delimed fleshings` was stored in the refrigerator at 4°C.

2.5 Extraction of Fat from Fleshings

The Soxhlet extractor was used to extract fat from the fleshings. The delimed fleshings weight about 62 g was placed into thimble, extraction solvent ethanol was added into the distillation flask and distillation flask was gently heated at 80°C for 4-6 hrs. The extracted fat into the distillation flask was heated at drying oven to remove the ethanol. The extracted fat was stored in refrigerator at 4°C. The extracted fat is shown in Fig. 3.

Fig.3: Extracted cowhide fat

2.6 Characterization of Extracted Fats

The physiochemical parameters such as iodine, saponification and acid values of extracted fat were determined by the following DIN 53241/IP 84/81, ISO 3657 and ISO EN 3682 standard methods respectively.

2.7 Preparation of Soap

A 20 g of extracted fat was taken in a 250 mL beaker and heated to melt. Then 25 mL of 20% sodium hydroxide (NaOH) was poured, mixture was constantly heated and stirred on magnetic hot plate. Because of heating some of the solvent (water) was evaporated, so water was added to the beaker in order to maintain the same volume. After saponifying fat with NaOH, liquid was become stringy and muddy looking before it was turned uniformly into a clear mixture of soap and glycerin. After 6-8 hours, the froth no longer rises and large white bubbles pop on the

surface. The end of saponification was determined 'ribbon' and 'taste' tests.

After completing saponification, the soap solution was poured into 100 mL saturated NaCl solution in 500 mL beaker and stirred with a stirring rod. The soap was coagulated into a solid mass and floated on the surface of the solution. Then beaker was placed into an ice-water bath. The solution was then filtered using a wire screen (instead of filter paper) to collect soap. The soap was then rinsed twice with 10 mL ice-water to remove the excess NaOH. Once the rinsed soap has drip dried, move it to a paper towel to finish drying. Then the soap was dried and allowed it to cure for several days.

2.8 Properties of Soap

2.8.1 Determination of solubility

Introducing a small amount of the soaps into the distilled water one at a time carried out the solubility test of soap in water. The solution was stirred and observations were made.

2.8.2 Determination of pH

About 1 g of the soap was dissolved in 10 mL distilled water in a beaker. It may help to heat the water to get the soap to dissolve completely. The pH of the soap solution was determined using the pH meter (UPH-314, UNILAB, USA).

2.8.3 Determination of lathering power

2 mL of distilled water was added into a test tube. An equal amount of soap solution was added to test tube and shaken vigorously by placing a stopper of the tube. This should give a permanent lather that lasts for at least 30sec. If the lather doesn't last, add another 10 drops of soap solution was added and shaken vigorously.

2.8.4 Determination of cleansing power

A drop of used brake oil was placed on a separate thin strip of filter paper. It was made sure that the strip of filter paper was fitted in the test tube. Filter paper with oil spot was placed in the tube containing soap in water. The tube was shaken well and made sure that the filter paper was immersed in the solution. After 2 minute the filter paper was removed and rinsed with tap water. Observation was made that did the oil of the filter paper strip get washed out or not.

3. RESUTS AND DISCUSSION

3.1 Characteristics of Extracted Fat

The physiochemical parameters of extracted fat are shown in Table 1.

Table 1: Properties of the extracted cowhide fat

Parameters	Observation
Physical state at room temperature	Solid
Iodine value	52.1 ± 0.6
Saponification value	188.5 ± 0.9
Acid value	32.0± 0.4

It was clear from the above Table 1 that the physiochemical parameters of the extracted fat were suitable for the soap preparation.

3.2 Properties of the Soap

The results were obtained from performed various tests with the soap are represented in Table 2. The soap was milky white in color. It was soluble in distilled water. The pH of the prepared soap was 8-9, which was within satisfactory limit. The pH was higher because of incomplete alkali hydrolysis resulting from the process of saponification. The pH could be achieved more satisfactory level by adding neutral fat or oil, glycerin etc. The soap was good lathering and cleansing power.

The results reveal that the extracted fat from the cowhide fleshings' was suitable for soap production. Better quality soap could be made by varying amount of fats and alkali used as well as incorporating different additives. The process could be commercially optimized for large-scale production.

Table 2: Properties of the soap

Parameters	Observation
Color	Milky white
Solubility in water	Soluble
pH	8-9
Lathering power	Good
Cleansing Power	Good

4. CONCLUSION

In this study fats were extracted from the cowhide fleshings by Soxhlet extractor using ethanol as solvent. The physiochemical analysis of the extracted fat concluded that the fat was useable for soap preparation. Soap was prepared by saponification using sodium hydroxide. The properties exhibited by the soap solution indicated that it is suitable for large-scale production. The process could be optimized for the commercial production. The present approach has dual benefits for the tannery: i) it allows the production of new valuable product for the commercial use and ii) it could reduce the environmental impact from the tannery.

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