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USE OF PLANT-DERIVED BIOSURFACTANTS IN LEATHER INDUSTRY

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In recent years, due to stricter environmental legislations and increasing concern of consumers on environmental pollution, studies regarding the investigation of environmentally friendly products alternative to polluting synthetic chemicals are receiving an increasingly deal of attention in leather industry.

Biosurfactants are surface-active biomolecules that have a great potential in numerous applications when compared to chemical surfactants, due to having advantages such as low toxicity, high biodegradability, ecological acceptability and biocompatibility [1-5]. In this context, plant-derived biosurfactants have an important potential in terms of being a resource for environmentally friendly products that can be used in multiple leather production processes like soaking and degreasing [1, 2, 7]. Saponins, a structurally diverse group of plant derived biosurfactants, are naturally occurring surface-active compounds that widely distributed in the plant kingdom and their presence have been reported in variety of plant species including soybeans, chickpeas, alfalfa, navy, mung, and kidney beans, horse chestnut, licorice, Mojave yucca and quillaja soap bark tree [2-4]. Quillaja and aescin are two of the most important sources of plant-derived saponins that obtained from Quillaja saponaria tree and horse chestnut seed, respectively.

Potential use of quillaja and aescin in soaking and degreasing process was studied in terms of their antimicrobial activity and degreasing efficiency. Each saponin was tested by using different concentrations of sapogenin, 0.125, 0.25, 0.5 and 1 g for antimicrobial activity, and 2.5, 3.125 and 3.75% for degreasing efficiency. The antimicrobial efficiency of saponins, with different sapogenin contents on microbial population of soaking liquor was determined within 8 and 24 hours of the soaking process.

The results of colony forming units show that the inhibition effect of quillaja saponin for 8h is nearly unchanged with the increasing quillaja saponin concentrations, unlike aescin. The numbers of viable bacterial cells in soaking liquors treated with quillaja saponin decreased with increased active sapogenin content for 24h of soaking process. On the contrary microbial population at aescin treated soaking liquors remained nearly unchanged for 24 hours. All applied concentrations of quillaja and aescin saponin provided lower number of viable bacterial cells in comparison to blank trials for 24 h, and better inhibition efficiency was obtained by higher concentrations. Although the microbial efficiency of aescin was approximately 15-21% lower than commercial biocides, microbial load of the soaking processes treated with increasing aescin saponin concentrations was found 5-10% under the cfu (colony-forming unit) results of the blank trials, which is a good sign of better protection of Aescin saponin in comparison to quillaja saponin considering the 0.4% and 1.3% difference obtained from blank and synthetic biocides respectively.

Optimum degreasing yield was obtained at 2.5% concentration for aescin, whereas higher dosage did not yield better efficiency, and nearly unchanged with increasing concentrations of aescin. Degreasing efficiency results of aescin (39%) are comparable to a conventional emulsifying agent (43%). In case of quillaja saponin, offer of 2.5% yielded comparable results (45%) to control trials, which has an approximate degreasing efficiency about 50%. On the other hand unlike aescin better degreasing efficiencies up to 82% was achieved with higher concentrations.

Use of aescin in degreasing process reduced COD load of degreasing process approximately up to 90%, whilst COD values for degreasing effluents were reduced up to 70%, with quillaja saponin, probably due to its higher degreasing efficiency. The properties of degreased leathers both with aescin and quillaja are comparable with those of conventionally processed leathers with respect to dye levelness and physical texture.

The results showed that both quillaja and aescin saponins have the potential to be viable and promising ecological alternatives to synthetic surfactants for leather industry.

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