ISSN : 0974 - 7435 Volume 9 Issue 5

BioTechnology
An Indian Journal

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BTAIJ, 9(5), 2014 [203-205]

Modified jatropha oil for making chamois leather

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ABSTRACT

Fish oil is extensively used in food, pharmaceutical industries and in general it is expensive, but low cost fish oil is used in leather industry for Chamois leathers manufacture. Oils in general, whether it is vegetable oil or marine oil, have higher viscosity and hence it takes longer time for penetration into the skin during oil tanning. In-addition, a significant amount is wasted in the drum during processing due to high viscosity of oils. Jatropha oil, is non-edible oil that is used for making soap, bio-fuel etc. is relatively cheap compared to fish oil. Therefore, in this study jatropha oil was trans-esterified using methanol and sulphuric acid to obtain jatropha oil methyl ester which is low in viscosity and this product is used for making chamois leather. This leather was tested for different properties such as water absorption and its strength. The experimental results show that the leathers made using jatropha oil methyl ester has similar properties that of conventional chamois leather and jatropha oil methyl ester could be a substitute to raw fish oil.

INTRODUCTION

Chamois leathers are special type of porous leather which has good absorption properties and are soft in nature. Therefore, it is used as wash leather. Generally, chamois leather is manufactured by application of oils such as fish oil[1], rubber seed oil[2], jatropha oil[3] and other vegetable oil[4] on the surface and exposing it to atmosphere for oxidation. Oils are viscous in nature and it takes 6-8 hours for the oil to penetrate into skin matrix during oil tanning. Subsequent oxidation of penetrated oils takes much longer time[5] normally 12-15 days hence oxidising agents such as hydrogen peroxide[6] are used in order to reduce the time for tanning processes. Since fish oils have bad odour, oils such as rubber seed oil and jatropha oil were tried but viscosity issue was not resolved. In this study jatropha oil was trans-esterified to obtain jatropha oil methyl ester which is low in viscosity compared to jatropha oil. This ester was used for making chamois leather.

EXPERIMENTAL

Jatropha oil methyl ester production

For the production of jatropha oil methyl ester, jatropha oil and methanol was taken in 1:6 mole ratios and the trans-esterification process was carried out using sulphuric acid as catalyst. 400mL of jatropha oil was taken and 120mL methanol was added along with 1.2mL sulphuric acid in a three necked RB flask and the reaction was carried out for about 14 hours. The temperature throughout the reaction was 66-68°C and speed of agitation was maintained at 400 rpm. After the formation of the methyl ester, the heating was stopped

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and methyl ester was separated by gravity separation using separating funnel. Glycerol layer was settled at the bottom and the methyl ester of jatropha oil at the top. The methyl ester was washed using hot distilled water so as to ensure that the pH of methyl ester is 7. The methyl ester was analysed using GC analysis for its composition.

Chamois leather manufacturing procedure

The skin that is to be processed was trimmed and was soaked overnight and the weight of the skin was calculated next day after draining the water. Unhairing was carried out in our experiment by application of paste of Sodium sulphide, lime and water of 2%, 10% and 40% respectively. It was covered with wet gunny bag for about 10 hours. The un-haired skin was re-limed using 10% lime, 1% soda ash and 300% of water and it was handled for 3 days continuously. Later, this was fleshed using hydraulic fleshing machines and the flesh was removed. The skin was de-limed using 1% ammonium chloride, 1% alkali bate and 200% water in the drum for 2 hours. The de-liming completion process was checked using phenolphthalein indicator. Aldehyde tanning was carried out using 2% glutaraldehyde and 150% water. Aldehyde was diluted with 10% water and was added to the drum as three feeds and the pH was maintained between 8 and 9. Later it was washed and kept overnight.

The oil tanning was carried out using three pieces of skin

i) 30% jatropha oil
ii) 25% jatropha methyl ester
iii) 30% fish oil

Initially oils were tested for different properties such as acid value, iodine value, saponification value as per the standard test methods. Calcium carbonate of 3% was mixed with oil and applied uniformly and drummed for 6 hours. The skins were hanged for 15 days to promote oxidation. The skins were weighed and washed with 500% water for one hour in drum. It was drained and treated with non-ionic wetting agent of 0.5%, and water 200%. The skin was washed using 500% water once again for 10 more minutes. The skin was treated with soda ash and water of 0.25% and 500% respectively. Treated skin was hanged for drying and were staked, buffed and samples were taken for different tests. The following physical tests[7] such as water absorption, sink test, stitch tear, tongue tear and shrinkage were tested. Initially oils were analysed for different physical and chemical properties as per the standard methods and their composition were analysed by Gas Chromatograph.

RESULTS AND DISCUSSIONS

TABLE 1 shows the acid value, iodine value and saponification values for jatropha oil and fish oil used in our study. The jatropha oil has lower acid value and Iodine value compared to Fish oil. The saponification value was almost equal for both oils.

TABLE 1 : Properties of jatropha and fish oil (Oil Characterisation)

	Jatropha oil	Fish oil
Acid Value	7	16
Iodine Value	114	150
Saponification Value	190	195

TABLE 2 shows the GC analysis results of jatropha and Fish oil. Jatropha oil is rich in C18:1, C18:2 fatty acids whereas fish oil is rich in C16:1, C20:5, C22:6.

TABLE 2 : Composition of jatropha oil and fish oil analysed by Gas Chromatograph

	16:0	16:1	18:0	18:1	18:2	20:5	22:6
Fish Oil	13.1	9.4	3.0	17.0	2.0	15.6	19.3
Jatropha Oil	14.8	0.9	6.5	41.7	35.6		

TABLE 3 : Shrinkage temperature of oil tanned leathers

Jatropha oil	80 °C
Jatropha oil methyl ester	79°C
Fish oil	82°C

Table 3 describes about the Shrinkage temperature of oil tanned leathers. The Jatropha oil methyl ester tanned leather has similar shrinkage to that of the other two oil tanned leathers.

Sink test was done to different oil tanned chamois leathers and the results are given in TABLE 4. It can be seen that the both jatropha oil and its methyl ester easily sinks in lesser time and has an advantage over the fish oil.

Jatropha oil methyl ester almost absorbs equivalent amount of water to that of the conventionally used oils.

TABLE 4 :Sink tests for different oil tanned leathers

Jatropha oil	50s
Jatropha oil methyl ester	40s
Fish oil	58s

TABLE 5 : Water absorption of different oil tanned leathers

Jatropha oil	295%(w/w)
Jatropha oil methyl ester	300%(w/w)
Fish oil	310%(w/w)

Hence it has an advantage of being less viscous in nature; it can penetrate in to leathers easily.

CONCLUSION

The chamois leather prepared using the methyl ester of jatropha oil is similar to the leathers tanned using fish oil. As jatropha oil methyl esters have less viscosity, the oil loss in the drum can be reduced. The chamois leathers obtained using jatropha oil methyl ester is not having any bad odour unlike fish oil tanned chamois leather. Therefore, this study indicates that good quality chamois leathers can be produced using jatropha oil methyl ester and by this way loss of oil in process drums can be reduced significantly. The chamois leather made using jatropha oil methyl ester is without bad smell and hence it can be used for a variety of applications.

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