160

LEATHER LUBRICANTS—PART V*
FATLIQUORING PROPERTIES OF CERTAIN NON-EDIBLE OILS

E. C. MATHEW, K. J. KEDLAYA & M. SANTAPPA

Central Leather Research Institute, Madras.

Fatliquoring properties of sulphated maroti oil (Hydrocarpus species) and illipe oil (Madhuca latifolia/longifolia) were studied.

Leather fatliquored with sulphated maroti oil has hard feel; sulphated products of blends of this oil with pungam oil has soft well lubricated feel. Illipe oil alone produces a sulphated fatliquor which is "soft soap" like in nature at room temperature, but the product emulsifies with hot water and lubricates leather well; fatliquored leather has smooth wax-like surface feel. The consistency of the fatliquor can be changed into liquid or thick cream by preparing sulphated product of the blends of illipe oil and pungam or castor oil or by sulphating transesterified product of illipe oil and a polyol; these products fatliquor leather well.

Main applications of oil in leather industry are (a) oiling/stuffing of leathers, (b) fatliquoring of mineral tanned leathers with emulsifiable products of oils and fats and (c) oil tanning. Sulphated products of castor, fish, neatsfoot and whale oil and sulphited products of fish and whale oil are the most commonly used fatliquors.[1] Sulphated products of blends of cocoanut oil and castor oil are also used as fatliquor for white leather.[1] India is rich in castor and sardine fish oil but deficient in neatsfoot oil and has no whale oil. Even the fish oil marketed contains good amount of free fatty acid (F.F.A. 50) and hence is not suitable for making the sulphated product as the free fatty acid in fatliquor causes spueing of leathers. At present, sulphated products of various edible oils like sesame oil are used to supplement the fatliquoring requirement of leather industry. Hence sulphated products of non-edible oil viz., (i) maroti oil and (ii) illipe oil and their blends with castor and/or pungam were prepared and used in fatliquoring of leathers. The behaviour of oils during sulphation was also recorded.

Preparation of sulphated products of oils or oil products

Sulphation of oil is a well known method of preparing emulsifiable product of oil; the oil while being agitated was treated with sulphuric acid and the temperature of the oil was maintained at 30–35°C. Sulphuric acid thus added is 25–30% of the weight of the oil. The oil thus sulphated was salted

*Paper read at the OTAI (Oil Technologists Association of India) symposium on "Problems and prospects in oils and fats, surface coatings and bleaching earth and active carbons" held at the Regional Research Laboratory, Hyderabad (India) during February 9–10, 1974.

out with brine and then neutralised to pH 7·7·5.

Fatliquoring test

Shaved chrome leather pieces were fatliquored with 4% (on shaved weight) of the product after neutralising the leather to pH 5.5 in a Wacker drum; duration of the fatliquoring was 45 minutes and the float used was 100%. The fatliquor was fixed to the leather with acetic acid if the exhaustion of the fatliquor was not complete. Leather pieces were piled overnight. Next day, the leathers were slickered, dried, sammed, staked and buffed. The fatliquored characteristics of leathers were assessed.

Results and discussion

It is seen from Table 1 that the normal rate of addition of sulphuric acid practised in sulphation of castor oil or pungam oil cannot be adopted in sulphation of maroti oil; the rate of addition of sulphuric acid has to be drastically reduced since maroti oil produced a resin-like substance on addition of sulphuric acid at the normal rate. Further the oil after sulphuric acid treatment had to be aged for at least three hours before salting out so that the resinous matter still present in the product became dispersible on neutralising the salted out product. The formation of resin like substance was an impediment to sulphation since stirring for uniform mixing of oil with the acid dropped was difficult. This could be avoided by blending maroti oil with other oils like pungam oil.

Leather fatliquored with sulphated maroti oil had hard feel and was somewhat coarse. The hard feel and coarse characteristics of the grain were decreased by using the sulphated product of blends of maroti oil with pungam oil; sulphated product of a blend of 1 part of maroti oil and 1 part of pungam oil imparts smooth and well lubricated feel to the leather; the leather, however, was not full. Preliminary investigations indicated that the ability of fatliquor of maroti oil or of its blends not to make leather soft could be utilised in fatliquoring of football leather as this leather should be firm and non-stretchy.

Sulphated illipe oil had "soft soap" like consistency. If the oil was blended with castor and or pungam oil before sulphation the ensuing product was thick paste or liquid depending on the content of the castor and/or pungam e.g., sulphated product of 1 part of illipe oil, $\frac{1}{8}$th part of castor and $\frac{1}{8}$th part of pungam was a thick liquid.

Leather fatliquored with sulphated illipe oil was very smooth and had soft well lubricated feel. The fatliquoring characteristics of sulphated blends of illipe and castor or pungam were obviously influenced by the content of these oils e.g., if castor oil content in the blend of oil sulphated was 50%, the fatliquored leather had well lubricated dry feel; dry feel was due to the content of sulphated castor oil in the blend

Maroti oil contains more than 70% of cyclic unsaturated fatty acids[4] viz. hydrocarpic, chavlmoogric and gorlic; gorlic fatty acid, however, also has unsaturation in the aliphatic side chain, but the gorlic acid content is less than 20%. The pentene rings of these fatty acids may not allow the fatliquor to penetrate leather well, this might be the reason for hard nature of leather fatliquored with sulphated maroti oil alone; coarseness of leathers fatliquored with sulphated maroti oil alone may also be due to this.

Double bond of the pentene is less susceptible to attack by sulphuric acid as

TABLE I

RESULTS FOR FATLIQUORED CHARACTERISTICS OF LEATHER

Oil/oils	*Behaviour of oil during sulphation*	*Nature of product*	*Characteristics of fatliquored leather*
1. Maroti oil	Oil gets resinified during the addition of sulphuric acid for sulphation: to decrease this, acid has to be added at a rate which is very slow as compared to that followed in sulphation of castor or pungam: further the product after addition of the acid has to be aged before salting out so that the resin is dispersible on neutralisation.	Paste like	Hard and grain is somewhat course
2. Maroti oil 2 parts + pungam oil 1 part	The resinification is less but still sulphuric acid has to be added very slowly during sulphation, the product has to be aged before salting out as in 1.	Paste like	Less hard and grain is less coarse
3. Maroti oil 1 part + pungam oil 1 part	Though resinification is less, sulphuric acid has to be added slowly as in previous case; the product has to be aged before salting out as in 1 and 2.	Liquid	Soft and smooth and does not have round feel
4. Illipe oil	No difficulty during sulphuric acid addition	'Soft soap' like	Soft, full, well lubricated with good surface smoothness
5. Illipe oil 1 part + castor oil 1 part	,,	Creamy reddish liquid	Soft, full, well lubricated, smooth with a little dry feel
6. Illipe oil 1 part + castor oil $\frac{1}{3}$ to $\frac{1}{2}$ part + pungam oil $\frac{1}{3}$ to $\frac{1}{2}$ part	,,	Reddish yellow liquid	Soft, full, well lubricated
7. Illipe oil 1 part + castor oil $\frac{1}{5}$th part + pungam oil $\frac{1}{5}$th part	,,	Thick liquid	Soft, full, well lubricated with good surface smoothness as in (4)

compared to the double bond of aliphatic chain of fatty acid. Hence sulphation at double bond site of pentone may not be quick resulting in the necessity of ageing the product for better sulphation and dispersibility of the final product. In the case of gorlic acid sulphation will also take place at the double bond of straight chain; the gorlic acid content being less, the influence of sulphation at this double bond may not be predominant.

Unlike oils like pungam or neatsfoot which contain more than 70% of unsaturated acid or castor oil which contains more than 80% of hydroxylated unsaturated fatty acid viz., recinoleic acid; illipe oil contains less than 60% unsaturated fatty acids; the higher percentage of saturated fatty acids as compared to that in the other oils resulted in "soft soap" like consistency of sulphated product. In the fatliquor of blends of illipe and castor and/or pungam the content of unsaturated fatty acid is obviously high; the greater percentage of unsaturation is the reason for the liquid nature of sulphated product of blended oils. As only unsaturated fatty acid chain of the oil molecule gets sulphated at double bond site and gets bound to the chrome of leather at the sulphated point, it results in orientation of the sulphated oil molecules such that saturated fatty acids of the oil molecules are mostly oriented away from chromium of chrome tanned leather. This good orientation of saturated fatty acids of the sulphated oil lubricant is the reason for smooth wax-like surface character of leathers fatliquored with sulphated illipe oil or blend containing predominantly illipe oil.

The solid soft soap-like consistency of sulphated illipe oil can also be altered by transesterifying the illipe oil by suitable polyol[3] e. g. polyglycol 300 - 1000 and then preparing the sulphated product. The transesterified product being itself hydrophilic remains liquid on sulphation because of possible sulphation at hydroxyl sites of ester and because of hydrophilic nature of non-sulphated ester of the oil which might be present in the product. The product besides lubricating leather will also impart smooth wax-like surface feel to the leather for the reasons discussed.

It is concluded that sulphated fatliquor of maroti oil along with other oil may be used in fatliquoring of leathers like football leather which requires leather to be firm and non-stretchy. Sulphated illipe oil or its blend with oils like pungam and castor to the extent of 10-20% or its transesterified product are good fatliquor for chrome tanned leather, especially when smooth wax-like surface character is desired.

REFERENCES

1. Kedlaya, K. J., Vijayalakshmi, K., Sumathi, S.C. & Muralidhara Rao, V. V., *Leath. Sci.*, 20, 199 (1973)

2. Hilditch, T. P. & Williams, P. N., "*The chemical constitution of natural fats*". Fourth Edition. Chapman & Hall., London (1964)

3. *Bailey's industrial oil and fat products*, 3rd Edition by D. Swern., Interscl., John Wiley and Sons, New York (1964)