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The Extraction of Wool Grease.

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THE medical importance of wool grease was appreciated by the ancient Greeks as early as 450 B.C. Through mediaeval periods its use is referred to in various writings, and the methods of preparation are discussed. Galen prepared an unguent having wool grease as its basis and this formula has persisted with little change until modern times. Even today it finds a wide application in medicine and particularly veterinary medicine, in the form of lanoline. Many firms, especially in Germany, specialise in these products. Lately Twort and Twort (1934) have established the value of lanoline treatment in preventing dermatitis and cancer where employees are in contact with the highly carcinogenic oils used in the textile industry. The protective action of wool grease on the fibre is well known and wool buyers attach much value to its presence and even distribution. It is considered by some to be of nutritive value to the fibre during its growth.

There appears to be little uniformity as to the nomenclature for the product of the sebaceous gland. Many writers prefer the name " wool fat ". This term is definitely misleading because the natural product contains very little true fat, i.e. glycerides. On the Continent " wool wax " is more often used. From the chemical point of view this is more correct. " Wool grease " is popularly used and, although chemically, it signifies little or nothing, it appears to be an acceptable name for this heterogeneous mixture of chemical compounds for the reason that " grease " does not specify any particular chemical combination.

It is problematic which compounds should be classed under " wool grease " and which under " suint ". Of the potassium salts of the fatty acids, that combination which is principally present, those of the higher members of the series dissolve to an appreciable extent in ether and will, therefore, be found in the ether extract of raw wool. The lower members, on the other hand, are soluble only in water and contribute a great part of the so-called suint.

As the differentiation mostly centres round products of suderiforous and sebaceous excretion respectively the products should be grouped in this fashion as far as possible. The interaction of akali from the suderiforous glands with free fatty acid from the sebaceous glands may form water soluble fatty acid salts, thus introducing an element of confusion. By regenerating these fatty acids from their salts in the suint and adding these to the " grease ", the result may be regarded as fairly true for " grease ". This decision is made because the water extract can never be a true index of suderiforous excretion. The water extract will include the water soluble foreign material of sand, dust, vegetable matter and manure, thus including organic and inorganic matter from these sources.

The object of this paper is to describe an improved method of extraction of wool grease without reference to the chemical composition or analysis of wool grease and suint. It is definitely known, however, that wool grease is rich in sterols including such substances as cholesterol, the so-called iso-cholesterol ($C_{26}H_{44}O$) and smaller quantities of lanolesterol and agnosterol, as separated by Freney (1934). There is a deplorable lack of corroborative data as to the final constituents of wool grease, mainly due to the absence of suitable analytical methods. Herbig (1926) reviewed many methods but expressed strong criticism of most of them. The standard analytical methods for analysis of fats and waxes cannot be applied directly to wool grease because it contains so many chemical compounds, not usually found in fats or waxes.

As regards laboratory methods for extraction of wool grease, there is a conspicuous lack of uniformity resulting in products of differing composition. Benzol, petroleum ethers of various boiling points, and motor spirits have all been used at times but the solvent most frequently employed would appear to be ethyl ether. Sutton (1931) dried wool at 105° C. and used dry ether, basing results on the weight of dry wool. Marston (1928) employed dry ether apparently on unconditioned wool and extracted for 48 hours.

The procedure adopted for the present was as follows: 50 gm. of greasy wool from the right shoulder is conditioned to 70° F. (21·5° C.) and 70 per cent. relative humidity until constant weight is obtained. It was then placed in a fine texture Whatman extraction thimble and dried over sulphuric acid for at least 12 hours at 70° C. under a vacuum of 25 mm. It is then quickly weighed and placed in a soxhlet extractor protected by a calcium chloride tube attached to the condenser. This preliminary drying prevents coloidal matter from passing through the filter during the subsequent extraction.

In looking for a suitable solvent it was found that all those with the higher boiling points tended to produce a dark coloured grease. Redistilled petroleum ether of boiling point of approximately 45° C. was found to be most suitable. Drummond and Baker (1929) in their valuable work on wool fat used petroleum " spirit " of boiling point of approximately 60° C. Replacement by syphoning of this

45° C. petroleum ether five times seems to extract most of the grease, for continuation of the extraction for twenty runnings only produces a further addition of an average of 0·45 per cent. of the total grease, extreme figures being 0·32 per cent. and 0·65 per cent. of the total grease. As no solvent, except probably benzol, was found to extract all the grease, the petroleum ether extracted samples were again extracted with dry ether which delivered a further 0·75 per cent. of the total grease. This ether extract, which was now perfectly clear, seems to have a much higher acid value than the bulk, acid values of approximately 100 being found, whereas the bulk usually shows about 10. This indicates that some of the free acids (possibly oxy-acids) are practically insoluble in petroleum ether. It will be realised that for most grease determinations it will be satisfactory to employ a low boiling point petroleum ether and to pass this through about ten times. The extracts were evaporated at a temperature of 50° C. and the flasks dried out in the vacuum dessicator previously employed (25 mm. and 70° C.) until constant in weight (approximately 6 hours).

Suint was determined by soxhlet extracting the degreased wool with hot water, evaporating on the water bath, drying as above and weighing the residue as rapidly as possible. Should it be felt desirable, the fatty acids should be liberated by acidification, extracted with ether and this quantity added to the petroleum ether and ether extracts already obtained. The pure dry wool values were obtained by applying the method of Botha (1937), where a weighed quantity of the extracted wool is dissolved in boiling normal caustic soda. The residue is then retained on a fine mesh sieve, dried, weighed and a correction factor brought in due to loss of weight as a result of the alkali attacking the vegetable matter to some extent. This gives the weight of foreign material and by difference that of wool.

Grease figures are often expressed as a percentage of the raw wool conditioned at 70° F. and 70 per cent. relative humidity. A more correct method is that described by Sutton (1931) and later by Bonsma (1934), where use is made of a fat or grease index which, at the same time, is also a percentage expressed in terms of pure dry wool.

$$\text{Grease index} = \frac{\text{Weight of grease} \times 100.}{\text{Weight of pure dry wool.}}$$

The final result is thus not affected by variation in suint, vegetable matter, water and particularly sand content. The method based on raw wool is only of value where actual yield is required as is the case with wool buyers, whereas the figures obtained by the "grease index" can easily be converted to suit this purpose if necessary.

The following results were obtained from the wool of the sheep in the sulphur supplement experiment of Steyn (1935).

	No.	Grease.	Suint.	Pure Dry wool.
Sulphur Supplement.....	1	48·9	11·6	49·8
	2	41·9	23·9	49·9
	3	42·8	14·5	52·3
	4	52·6	14·0	54·1
	5	44·8	10·5	47·5
	6	67·1	20·5	52·1
	Average	49·7 ± 3·8	15·8 ± 2·1	51·0 ± 1·0
Controls.....	7	46·0	18·2	50·2
	8	43·0	10·1	54·1
	9	36·3	12·2	50·0
	10	28·7	18·4	46·1
	11	54·2	13·5	49·4
	12	42·3	16·2	44·1
	13	39·2	10·6	54·8
	14	40·9	13·4	53·1
	Average	41·3 ± 2·6	14·1 ± 1·1	50·2 ± 1·3

Although there appears to be a difference in the average grease content between the groups it is obvious that none of the differences could be considered statistically significant, indicating that the sebaceous and suderiforous excretions have not changed as a result of the sulphur supplement. The increase in weight which Steyn (1935) found is thus not due to the increase of wool grease or suint.

This method of extraction not only seems to produce consistent results but has the additional advantage of extracting the grease more fully and apparently also in a purer form. It is a comparatively quick method when extremely accurate results are not required.

Summary.

A method for the extraction of wool grease by means of low boiling point petroleum ether is described.

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