The Recovery and Purification of Wool Fat

A Discussion of the Economic Possibility of an Important Raw Material

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RAW wool contains approximately between five and ten per-cent of wool fat. The first step in the treatment of the raw wool is the removal of these fatty constituents known collectively as Wool Fat, Wool Grease or Degras. For the accomplishment of this two radically different methods come under consideration.

Methods of Recovery

The first involves removal by means of solvent extraction, organic solvents, such as benzine, gasoline, trichlorethylene, etc., being employed.

The second method depends upon an extraction process with dilute soap solutions to which mildly alkaline substances are added, such as sodium carbonate or ammonia or both. In this case the constituents making up the wool fat do not go into an actual solution but form an intimate emulsion with the water rendered stable by the presence of the soap. From such liquids, after separation from the wool, the wool fat can be recovered by simple methods which may be of either a mechanical (physical) or a chemical nature or a combination of these. The separation can be brought about by heating to a certain temperature and allowing to settle by gravity, or it can be accelerated by employing a combination of heat and centrifugal force. It may be accomplished chemically by treatment with a suitable quantity of an acid, such as sulphuric, a product being obtained in this case which contains, in addition to the natural wool fat constituents, the fatty acids derived from the chemical decomposition of the soap employed, which free fatty acids, in turn, are removed at a later stage.

Of these two methods only this latter one seems to have come into extensive use, accordingly, it will be dealt with further in detail.

The raw wool, containing probably from 5 to 10 per cent. of fat constituents, is treated in large tanks with a weak aqueous solution of soap with the addition of soda ash, the tanks having suitable stirring devices so as to facilitate the detergent action on the raw wool. The wash waters are then pumped into other tanks or containers, and the separation of the wool fat brought about by raising the temperature to about 140 degrees F. and maintaining it at that point. The separation of the wool fat takes place in a period of time which may vary from one day to several weeks, this difference being due to difference in the nature of the wool fat contained in different kinds of wool. This separation can be greatly expedited by an employment of centrifugal force in conjunction with the heat treatment. Much work has been done on this line of late.

The essentials are: (a) Separation to be efficient for the lowest possible temperature, (b) The delivery of the separated wool fat must be continuous, (c) Separation must be equally efficient with any percentage of wool fat. The selection of the proper type of centri-

fugal for this work is of prime importance.

Proposals for Purification

The purification of wool fat can be accomplished by a combination of washing and treatment with chemical bleaching agents. Elimination of odor depends not so much on the actual removal of the odoriferous substances (butyric and caproic acids) as on their reduction, condensation or neutralization. For bleaching the wool fat sulphur dioxide appears to give the best results. Chlorine in a nascent state is good.

German Patent., D. R. P. 404 709 Kl. 23a Gr. 3 proposes a method for the treatment or purification of wool fat which consists of heating with water under pressure for several hours, followed by distillation, directly or with the aid of superheated steam, with or without the use of a vacuum. It has been found possible to recover the soap used in extraction of the wool fat from the raw wool (scouring).

It has been customary, to some extent, to accomplish this indirectly, chemically, using sulphuric acid to obtain the free fatty acids of the soap, then recombining these with caustic soda. It has, however, been found to be feasible to directly recover the soap as such, thus eliminating the expense of the sulphuric acid and the caustic soda. This is accomplished by a simple evaporation process. It is, possible, furthermore, in this method to increase the total yield of wool fat by removal of such as is still contained in the soap solution by solvent extraction, using benzine. The additional wool fat thus recovered would otherwise pass over into the fatty acids separated.

The advantage of an improved and rational method of wool fat extraction and recovery as outlined is: (1) A great reduction in the tank capacity required. (2) Reduction in the cost of steam by the shortening of time required. (3) Lessening of cost of material, sulphuric acid and caustic soda being dispensed with.

It is possible to combine extraction with soap solution and solvent extraction, the soap solutions containing the wool fat being extracted with benzine which takes up the wool fat, the spent soap being recovered as described above from the waters.

Methods have been proposed and utilized involving the conversion of the spent soap or the free fatty acids derived from the same, after the previous removal of the wool fat, into lime or other insoluble soaps, but this has not been found to be practicable from an economic standpoint.

Composition of Wool Fat

While the chemistry of wool fat by no means can be considered as settled, that is to say, as far as knowledge of all of the constituents of the material is concerned, it has been shown that a large portion consists of cholesterol compounds; partly free cholesterol, partly esters of cholesterol. The exact nature of the acids for the most part forming esters with a part of the cholesterol has not yet been clearly elucidated. Some of them are believed to be hydroxy acids. When wool fat is subjected to distillation under diminished pressure, a chemical decomposition takes place; the cholesterol portion giving rise to unsaturated hydrocarbons with two double bonds. Cholesterol itself is a secondary alcohol of an alicyclic structure with one double bond. The acid portion similarly undergoes a decomposition, the alpha hy-

droxy acids forming lactides on heating, the beta hydroxy acids, losing carbon dioxide and forming solid isomers of oleic acid, the gamma and delta acids forming lactones.

Further, there are present in wool fat two isomers of cholesterol which have been termed isocholesterol and metacholesterol. Ceryl alcohol and oleic acid are believed to be present in small quantity.

Cholesterol forms esters with acids, some of which possess characteristic properties and are of use in the isolation of cholesterol. Digitonin, a glucoside occurring in the seeds of the foxglove (Digitalis purpurea) has the remarkable property of forming a stable molecular compound with cholesterol, but does not form any compounds with its esters. This fact is interesting as it can be applied, even quantitatively, in differentiation between free or combined cholesterol, as it occurs in natural products, such as wool fat.

Possible Developments

By distillation under pressure, a process which can be applied to the crude grades of wool fat, it is possible to obtain a pure white paraffine-like product of a neutral reaction, consisting, presumably, of hydrocarbons, which may prove to be of value.

According to German Patent 326,933 addition to Patent 286,-244, a wax can be produced from the alkali soaps of wool fat by precipitation with an aqueous solution of a soluble magnesium salt. The precipitate is dissolved in boiling alcohol, the solution filtered off from any insoluble matter and allowed to cool, when a light colored crystalline magma of the wax products results. A further yield can be obtained from the filtrate by addition of water. It is feasible to obtain similar compounds using salts of iron, zinc, lead and other metals in place of magnesium.

The more or less crude grades of wool fat find use in the production of textile oils and in the preparation of lubricants. The more refined grades are utilized in the production of the so-called lanolin, largely used for pharmaceutical purposes and in the production of cosmetics.

The waste products and material too dark in color to lend itself to a process of purification can be utilized, the waste containing alkali salts and other mineral matter can be dried and ground into a fertilizer, the waste of oily or fatty nature might be utilized for the production of a fuel gas by destructive distillation.

Aside from its well known application in pharmacy as lanolin and the widespread use of degras in textile sizing, it is thus seen that waxes of value may be produced. Pyrogenetic decomposition may lead to commercial processes for the production of isomeric oleic acids, which in turn may be converted into paint driers by combination with metals to form salts similar to lead oleate. Saponification of the cholesterol esters may yield valuable fatty acids, which are as yet of doubtful constitution.

The application of chemistry to wool fat is a matter which requires reinvestigation. Most of the product today represents a waste of the wool industry, as with the exception of the highly refined lanolin the material is not of great value. The constituents of wool fat represent a potential source of valuable material, and the manufacturer who undertakes the development of processes for the separation and

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Trade Conference of Edible Oil Industry

The Federal Trade Commission announces that it has approved plans for holding a trade practice conference of the edible oil industry with a view to bringing about elimination of alleged unfair trade practices. Seventy per cent of the representatives of this business have assured the commission of their desire to take part in such a gathering at an early date. No time for the conference has been set, but the commission has designated Commissioner J. F. Nugent to represent it at the meeting.

As stated in a recent Information Letter, methods of packing salad dressings made from olive oil and cottonseed oil will be discussed. It is said there are differences of opinion as to what constitutes the weight of a gallon of oil, and in an effort to obtain expert advice on this subject the industry has approved plans to invite to the conference specialists from the Department of Agriculture and the Bureau of Standards. It is asserted that a gallon of salad oil varies both in weight and volume with the degree of temperature at the time of packing and that consequently packers have had difficulty in maintaining accurate measurements. These conditions have brought on confusion and prominent members of the industry express the hope that a standard weight will be established at a trade practice conference.

Sale of cottonseed oil for pure olive oil salad dressing is another practice said to exist at times and it will be taken up at the conference.

This meeting will undoubtedly draw a large attendance of oil refiners, brokers, and dealers.

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sale of the several substances present should be well rewarded for his efforts.

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