

# PATENT SPECIFICATION

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## PROVISIONAL SPECIFICATION

### Improvements in the processing of wool wax alcohols and products derived therefrom.

We, FULMER RESEARCH INSTITUTE LIMITED, a British Company, of Holly Hill, Stoke Poges, Buckinghamshire, and EDGAR SCOTT LOWER, a British Subject, of "Tahra," 5 Bridge Road, Rawcliffe Bridge, Near Goole, Yorkshire, do hereby declare the nature of this invention to be as follows:—

Broadly, this invention consists in improving the surface active properties and/or solubility (including colloidal solubility) in water of the mixed wool wax alcohols derived from wool grease, also known as lanoline or wool wax or wool fat.

The mixed wool wax alcohols may be derived from wool grease recovered from suds discharged from wool washing factories, or from grease recovered from sewer effluents.

The invention is more especially but not exclusively directed to improving the surface active properties and/or solubility (including

colloidal solubility) in water of those mixed wool wax alcohols marketed under the proprietary name of "Hartolan" grade of wool wax alcohols.

Further, the invention consists in improving the ability of the aforesaid wool wax alcohols to act as an emulsifying agent for the production of the oil-in-water type of emulsion of a great variety of water-insoluble or difficultly soluble organic materials with or without admixture of clarifying agents, additional stabilising agents, and so forth.

The mixture of wool wax alcohols obtained from wool grease consists mainly of sterols, triterpene-like alcohols, aliphatic alcohols, and related substances of uncertain constitution. The relative proportions of the various constituents may vary in different samples, but an example of the approximate composition is:—

Group	Name	Formula	Weight %	
45 Aliphatic Alcohols	"Ceryl"	$C_{26}H_{54}O$	60	
	Cetyl	$C_{16}H_{34}O$		12
	"Carnaubyl"	$C_{24}H_{50}O$		—
	Lanolin	$C_{12}H_{24}O$		1
	Lano-octadecyl	$C_{18}H_{38}O$		12
	Lanyl	$C_{21}H_{42}O_2$		—
	Long chain	$C_{26-27}$		65
50 Sterols	Unsaturated	$C_{10-12}$	—	
	Cholestanol	$C_{27}H_{48}O$	2.5-5.1	
	Cholesterol	$C_{27}H_{46}O$	25.5-33.1	
	7-Dehydrocholesterol	$C_{27}H_{44}O$	—	
	Ergosterol	$C_{28}H_{44}O$	0.002-0.0035	
55 "Metacholesterol"	"Oxycholesterol"	$C_{27}H_{46}O_2$	70	
	—	—	—	
Triterpene Alcohols	Agnosterol	$C_{30}H_{48}O$	0-5.3	
	Lanosterol	$C_{30}H_{50}O$	21.3-26.6	

75 The average analysis by the usual methods and some properties of a typical grade of wool wax alcohols mixture is:—

80	Ash ... ..	0.23-0.25 per cent.	85
	Unsaponifiable matter ... ..	97 per cent.	
	Volatile matter ... ..	0.4 per cent.	
	Water soluble matter ... ..	<1 per cent.	
	Acid value ... ..	1.8 mgms.	
Acetyl value ... ..	130	90	

	Ester value ... ..	2.0	10
	Iodine value (Wijs) ... ..	45.5	
	Mean molecular weight ... ..	377	
	pH value ... ..	5.7	
5	Specific Optical Rotation ... ..	D <sup>20</sup> -11.8°	
	Saponification value ... ..	8.0	15
	Specific Gravity at 15.5°C. ... ..	0.965	
	Melting Point ... ..	~60°C.	
	Viscosity at 200°F. (Redwood No. 1) ... ..	216 sec.	

However, the invention is not restricted to mixtures of wool wax alcohols of the composition, properties and analysis exemplified above.

As is well known, the mixed wool wax alcohols themselves have good emulsifying properties and form valuable emulsifying agents and emulsion stabilisers for (in general) water-in-oil emulsions. Previous experiments have shown that no single fraction of the wool wax alcohols is responsible for the good emulsifying properties of the parent mixture. Cholesterol itself, which is one of the principal constituents of the wool wax alcohols mixture, although water-insoluble, is a good emulsifying agent when blended with, for example, oils and water, giving water-in-oil type emulsions, but it is an even better emulsifying agent when used in admixture with the other wool wax alcohols. It is also known that aqueous colloidal solutions (sols) of cholesterol and of the mixed wool wax alcohols can be obtained by discharging their solutions in organic solvents into warm water or soap solutions. The sols so obtained are, however, sometimes rather unstable and sensitive to pH changes. There is also a limit to the amount of cholesterol which can remain in colloidal suspension in these sols. Solutions of wool wax alcohols in water/alcohol mixtures have been obtained with the aid of soaps, whilst clear aqueous solutions of cholesterol have been obtained by heating it with a polyethylene glycol ether of a higher fatty alcohol such as oleyl alcohol.

A mixture of wool wax alcohols containing cholesterol combines the emollient properties of the aliphatic alcohols with the non-congestive properties of cholesterol. Such mixtures have extensive use in cosmetic preparations and in the pharmaceutical and textile and other industries. Examples of some of their applications are:— in absorption bases for nourishing creams and emollients in general; in cosmetic creams and skin lotions; in hair creams, hair tonics, shampoos and permanent wave solutions; in superfatting compounds for soaps; in polishes; in dispersion agents for dyestuffs; in the fat-liquoring of leather; in wool scouring; in processing wool fibres and artificial silk; in dressing, cleansing, wetting, foaming, dispersing and lubricating agents for textiles; in softening agents for textiles and leather; in water-proofing agents for textiles, leather and

paper.

An object of the present invention is to make the mixed wool wax alcohols better suited to specific purposes amongst the variety of uses to which they have already been put and to further extend their range of usefulness, for example for making oil-in-water emulsions.

Previously it has been proposed to react a large variety of organic substances, both artificial and natural, such as fats, waxes, fatty acids, esters, alcohols, cholesterol, amines, and so forth, with ethylene oxide and other alkylene oxides, either in their monomeric or polymeric forms, in order to render them more water-soluble or to increase their emulsifying power in water usually in such proportions that at least four alkylene oxide units (and mostly more than four such units) are introduced into each molecule (or "average molecule") of the starting material.

It has now been found, that this constitutes the subject of the invention, that the surface active properties and/or the solubility (including colloidal solubility) of the mixed wool wax alcohols and/or their emulsifiability and/or their ability to act as emulsifying agents or emulsion stabilisers, especially in water, can be adjusted to a desired specific purpose by reacting the mixed wool wax alcohols at elevated temperatures of the order of 130-170°C. with suitably chosen amounts of ethylene oxide, either in the liquid or vapour state, with or without the use of super-atmospheric pressures, and with the addition of a catalyst such as for example sodium methoxide.

If liquid ethylene oxide is employed for the production of highly oxyethylated wool wax alcohols, it is preferably added in stages. If the vapour of ethylene oxide is employed it may be advantageous to use it under pressure.

Wool wax alcohols, prior to the treatment outlined herein, are not suitable for making oil-in-water emulsions as distinct from water-in-oil emulsions, whereas oxyethylated wool wax alcohols are suitable for this purpose.

#### EXAMPLE 1.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture, and 1 part by weight of sodium methoxide dissolved in the minimum quantity of methanol were separately introduced into an agitated vessel immersed in a heating bath. This vessel was

connected by a tube to a second vessel containing 58½ parts by weight of cooled liquid ethylene oxide. The entire pressure-tight system was evacuated to remove air and 5 methanol, and was then closed. The contents of the first vessel were then heated to a temperature of about 130°C., and the refrigerant bath was removed from the ethylene oxide which was thus enabled to attain room 10 temperature and exert in the system the corresponding saturation vapour pressure, approximately 1½ atmospheres. The ethylene oxide vapour, being in contact with the hot wool wax alcohols mixture and catalyst, was 15 gradually absorbed by the mixture, and more liquid ethylene oxide could thus vaporise to maintain the vapour pressure. Towards the end of the absorption reaction, the temperature of the contents of the first vessel was 20 raised to about 170°C. and the vapour pressure of the ethylene oxide was increased by applying a heating bath at about 50°C. to the ethylene oxide reservoir or second vessel. The saturation vapour pressure of the ethylene 25 oxide was thus increased to about 3½ atmospheres. This procedure was adopted in order to maintain a sufficiently high rate of absorption, because the absorption tends to decrease for a given set of conditions of 30 temperature and pressure as more and more units of ethylene oxide are introduced into the wool wax alcohols mixture.

Taking the "average molecular weight" (estimated) of the original wool wax alcohols 35 mixture to be 377, the oxyethylated wool wax alcohols mixture made by the process described in Example 1 contained an average of approximately 5 molecular units of ethylene oxide per "molecule" of starting material. 40 This new product was a soft brown wax, and could be readily dispersed (with foaming) in water to give a pale-yellow, finely dispersed emulsion of the oil-in-water type whereas the original wool wax alcohols mixture 45 did not.

Products produced according to Example 1 are useful emulsifiers for the manufacture of oil-in-water emulsions. An example of the preparation of such an emulsion is as follows:—

30 per cent by weight of petroleum jelly, 2 per cent by weight of wool wax alcohols mixture and 10 per cent by weight of the product made according to the above Example 1, are melted together and heated to 55 80°C. Separately 58 per cent by weight of water is heated to 85°C. and poured in a thin stream into the melted fatty product; at the same time the whole mixture is stirred with, 60 preferably, a high-speed stirrer. Stirring is continued until the temperature of the emulsion has fallen to 30°C. or in the region of this figure. A viscous semi-solid, oil-in-water emulsion results, and this should prove suitable 65 for use in cosmetic manufacture and in

the manufacture of pharmaceutical ointments and the like.

#### EXAMPLE 2.

Example 1 was repeated employing only approximately two molecules of ethylene oxide per molecule of starting material. 75

The product should prove of particular interest as an additive to mineral and vegetable oils intended for application to textile fibres, particularly when these oils have subsequently 75 to be removed. The presence of these additives in the oils renders the oils far more easily removable from the fibres than would be the case if the additives were not there.

#### EXAMPLE 3.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 93½ parts by weight of ethylene oxide, using 1 part by weight of sodium methoxide catalyst, and employing substantially the same 85 conditions of temperature and pressure and general procedure as in Example 1.

The oxyethylated product so made contained an average of approximately 8 molecular units of ethylene oxide per "molecule" 90 of starting material. This new product was a soft brown wax, and could be readily dispersed (with foaming) in water to give a pale-yellow, finely dispersed emulsion of the oil-in-water type. 95

A viscous liquid emulsion is produced, which is suitable for use as a cosmetic lotion or the like, if the product of Example 3 is replaced for that of Example 1, in the formula for the preparation of the emulsion described after Example 1. 100

#### EXAMPLE 4.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 245 parts by weight of ethylene oxide, using 105 2 parts by weight of sodium methoxide catalyst, and employing substantially the same conditions of temperature and pressure and general procedure as in Example 1.

The oxyethylated product contained an average of approximately 21 molecular units of ethylene oxide per "molecule" of starting material. This new product was a soft wax, of light brown colour, and could be readily dissolved (with foaming) in water to give a 115 lemon-yellow slightly opalescent solution.

#### EXAMPLE 5.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 502 parts by weight of ethylene oxide, using 120 2 parts by weight of sodium methoxide catalyst, and employing substantially the same conditions of temperature and pressure and general procedure as in Example 1.

The oxyethylated product contained an average of approximately 43 molecular units of ethylene oxide per "molecule" of starting material. This new product was a wax, of light brown colour, and could be readily dissolved in water to give a clear lemon-yellow 130

solution.

EXAMPLE 6.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 5 702 parts by weight of ethylene oxide, using 2 parts by weight of sodium methoxide catalyst, employing essentially the same procedure as in Example 1.

Materials produced according to Examples 10 1-6 will in general have uses as emulsifiers, wetting agents, dispersing agents, detergents, levelling agents in dyeing operations, penetrants and solubilising agents. Their efficiency for a particular purpose is dependent 15 to some extent upon the amount of ethylene oxide combined in the product, and, therefore, the material produced in accordance with one Example may be more suitable for a given purpose than that in accordance with

another. Even greater quantities of ethylene oxide may be combined with the wool wax alcohols and we do not limit ourselves to the quantities (i.e., ratio of oxide to alcohols) given in the Examples.

The new derivatives of wool wax alcohols, 25 except those of Examples 1 and 2, are insoluble or substantially insoluble in mineral and vegetable oils but are either soluble or dispersible in water or in aqueous solutions; the products of Examples 1 and 2 are largely 30 insoluble in water or aqueous solutions but are substantially dispersible therein, and are also easily dispersible in oil.

Dated this 27th day of April, 1948.

H. D. FITZPATRICK & CO.,

Chartered Patent Agents,

27, Chancery Lane, London, W.C.2. and

94, Hope Street, Glasgow.

COMPLETE SPECIFICATION

Improvements in the processing of wool wax alcohols and products derived therefrom.

We, FULMER RESEARCH INSTITUTE LIMITED, a British Company, of Holly Hill, Stoke Poges, Buckinghamshire, and EDGAR SCOTT LOWER, a British Subject, of "Tahra," Bridge Road, Rawcliffe Bridge, Near Goole, Yorkshire, do hereby declare the nature of 40 this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Broadly, this invention consists in improving 45 the surface active properties and/or solubility (including colloidal solubility) in water of the mixed wool wax alcohols derived from wool grease, also known as lanoline or wool wax or wool fat.

50 The mixed wool wax alcohols may be derived from wool grease recovered from suds discharged from wool washing factories, or from grease recovered from sewer effluents.

The invention is more especially but not

exclusively directed to improving the surface 55 active properties and/or solubility (including colloidal solubility) in water of those mixed wool wax alcohols marketed under the proprietary name of "Hartolan" grade of wool wax alcohols. 60

Further, the invention consists in improving the ability of the aforesaid wool wax alcohols to act as an emulsifying agent for the production of the oil-in-water type of emulsion of a great variety of water-insoluble 65 or difficultly soluble organic materials with or without admixture of clarifying agents, additional stabilising agents, and so forth.

The mixture of wool wax alcohols obtained from wool grease consists mainly of sterols, 70 triterpene-like alcohols, aliphatic alcohols, and related substances of uncertain constitution. The relative proportions of the various constituents may vary in different samples, but an example of the approximate composition is:— 75

	Group	Name	Formula	Weight %	
80	Aliphatic Alcohols	"Ceryl"	$C_{24}H_{50}O$	12	95
		Cetyl	$C_{16}H_{34}O$		
		"Carnaubyl"	$C_{24}H_{50}O$	—	
		Lanolin	$C_{12}H_{24}O$	1	
		Lano-octadecyl	$C_{18}H_{38}O$	12	
		Lanyl	$C_{21}H_{42}O_2$		
85	Sterols	Long chain	$C_{26-27}$	—	
		Unsaturated	$C_{10-12}$	—	
		Cholestanol	$C_{27}H_{48}O$	2.5-5.1	
		Cholesterol	$C_{27}H_{46}O$	25.5-38.1	
		7-Dehydrocholesterol	$C_{27}H_{44}O$	—	
90	Sterols	Ergosterol	$C_{28}H_{44}O$	0.002-0.0035	105
		"Metacholesterol"	—	—	
		"Oxycholesterol"	$C_{27}H_{46}O_2$	—	
		Agnosterol	$C_{30}H_{48}O$	0-5.3	
	Triterpene Alcohols	Lanosterol	$C_{30}H_{50}O$	21.3-26.6	110

The average analysis by the usual methods and some properties of a typical grade of wool wax alcohols mixture is:—

	Ash ... ..	0.23-0.25 per cent.	20
	Unsaponifiable matter ... ..	97 per cent.	
5	Volatile matter ... ..	0.4 per cent.	
	Water soluble matter ... ..	1 per cent.	
	Acid value ... ..	1.8 mgms.	
	Acetyl value ... ..	130	25
	Ester value ... ..	2.0	
10	Iodine value (Wijs) ... ..	45.5	
	Mean molecular weight ... ..	377	
	pH value ... ..	5.7	
	Specific Optical Rotation ... ..	D <sup>20</sup> -11.8°	30
	Saponification value ... ..	8.0	
15	Specific Gravity at 15.5°C. ... ..	0.965	
	Melting Point ... ..	60°C.	
	Viscosity at 200°F. (Redwood No. 1) ... ..	216 sec.	

35 However, the invention is not restricted to mixtures of wool wax alcohols of the composition, properties and analysis exemplified above.

As is well known, the mixed wool wax alcohols themselves have good emulsifying properties and form valuable emulsifying agents and emulsion stabilisers for (in general) water-in-oil emulsions. Previous experiments have shown that no single fraction of the wool wax alcohols is responsible for the good emulsifying properties of the parent mixture. Cholesterol itself, which is one of the principal constituents of the wool wax alcohols mixtures, although water-insoluble, is a good emulsifying agent when blended with, for example, oils and water, giving water-in-oil type emulsions, but it is an even better emulsifying agent when used in admixture with the other wool wax alcohols. It is also known that aqueous colloidal solutions (sols) of cholesterol and of the mixed wool wax alcohols can be obtained by discharging their solutions in organic solvents into warm water or soap solutions. The sols so obtained are, however, sometimes rather unstable and sensitive to pH changes. There is also a limit to the amount of cholesterol which can remain in colloidal suspension in these sols. Solutions of wool wax alcohols in water/alcohol mixtures have been obtained with the aid of soaps, whilst clear aqueous solutions of cholesterol have been obtained by heating it with a polyethylene glycol ether of a higher fatty alcohol such as oleyl alcohol.

70 A mixture of wool wax alcohols containing cholesterol combines the emollient properties of the aliphatic alcohols with the non-congestive properties of cholesterol. Such mixtures have extensive use in cosmetic preparations and in the pharmaceutical and textile and other industries. Examples of some of their applications are:— in absorption bases for nourishing creams and emollients in general; in cosmetic creams and skin lotions; in hair creams, hair tonics, shampoos and permanent wave solutions; in superfat-

ting compounds for soaps; in polishes; in dispersion agents for dyestuffs; in the fatliquoring of leather; in wool scouring; in processing wool fibres and artificial silk; in dressing, cleansing, wetting, foaming, dispersing and lubricating agents for textiles; in softening agents for textiles and leather; in water-proofing agents for textiles, leather and paper.

An object of the present invention is to make the mixed wool wax alcohols better suited to specific purposes amongst the variety of uses to which they have already been put and to further extend their range of usefulness, for example for making oil-in-water emulsions.

Previously it has been proposed to react a large variety of organic substances, both artificial and natural, such as fats, waxes, fatty acids, esters, alcohols, cholesterol, amines, and so forth, with ethylene oxide and other alkylene oxides, either in their monomeric or polymeric forms, in order to render them more water-soluble or to increase their emulsifying power in water usually in such proportions that at least four alkylene oxide units (and mostly more than four such units) are introduced into each molecule (or "average molecule") of the starting material.

110 It has now been found, and this constitutes the subject of the invention, that the surface active properties and/or the solubility (including colloidal solubility) of the mixed wool wax alcohols and/or their emulsifiability and/or their ability to act as emulsifying agents or emulsion stabilisers, especially in water, can be adjusted to a desired specific purpose by reacting the mixed wool wax alcohols at elevated temperatures of the order of 130-170°C. and in the presence of a catalytically active base, such as for example sodium methoxide, with ethylene oxide, either in the liquid or vapour state, with or without the use of super-atmospheric pressures. The amount of ethylene oxide used is dependent on the desired degree of solubility of the product.

If liquid ethylene oxide is employed for the production of highly oxyethylated wool wax alcohols, it is preferably added in stages. If the vapour of ethylene oxide is employed in may be advantageous to use it under pressure.

Wool wax alcohols, prior to the treatment outlined herein, are not suitable for making oil-in-water emulsions as distinct from water-in-oil emulsions, whereas oxyethylated wool wax alcohols are suitable for this purpose.

#### EXAMPLE 1.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture, and 1 part by weight of sodium methoxide dissolved in the minimum quantity of methanol were separately introduced into an agitated vessel immersed in a heating bath. This vessel was connected by a tube to a second vessel containing 58½ parts by weight of cooled liquid ethylene oxide. The entire pressure-tight system was evacuated to remove air and methanol, and was then closed. The contents of the first vessel were then heated to a temperature of about 130°C., and the refrigerant bath was removed from the ethylene oxide which was thus enabled to attain room temperature and exert in the system the corresponding saturation vapour pressure, approximately 1½ atmospheres. The ethylene oxide vapour, being in contact with the hot wool wax alcohols mixture and catalyst, was gradually absorbed by the mixture, and more liquid ethylene oxide could thus vaporise to maintain the vapour pressure. Towards the end of the absorption reaction, the temperature of the contents of the first vessel was raised to about 170°C., and the vapour pressure of the ethylene oxide was increased by applying a heating bath at about 50°C., to the ethylene oxide reservoir or second vessel. The saturation vapour pressure of the ethylene oxide was thus increased to about 3½ atmospheres. This procedure was adopted in order to maintain a sufficiently high rate of absorption, because the absorption tends to decrease for a given set of conditions of temperature and pressure as more and more units of ethylene oxide are introduced into the wool wax alcohols mixture.

Taking the "average molecular weight" (estimated) of the original wool wax alcohols mixture to be 377, the oxyethylated wool wax alcohols mixture made by the process described in Example 1 contained an average of approximately 5 molecular units of ethylene oxide per "molecule" of starting material. This new product was a soft brown wax, and could be readily dispersed (with foaming) in water to give a pale-yellow, finely dispersed emulsion of the oil-in-water type whereas the original wool wax alcohols mixture did not.

Products produced according to Example 1 are useful emulsifiers for the manufacture of oil-in-water emulsions. An example of

the preparation of such an emulsion is as follows:—

30 per cent by weight of petroleum jelly, 2 per cent by weight of wool wax alcohols mixture and 10 per cent by weight of the product made according to the above Example 1, are melted together and heated to 80°C. Separately 58 per cent by weight of water is heated to 85°C., and poured in a thin stream into the melted fatty product; at the same time the whole mixture is stirred with, preferably, a high-speed stirrer. Stirring is continued until the temperature of the emulsion has fallen to 30°C., or in the region of this figure. A viscous semi-solid, oil-in-water emulsion results, and this should prove suitable for use in cosmetic manufacture and in the manufacture of pharmaceutical ointments and the like.

#### EXAMPLE 2.

Example 1 was repeated employing only approximately two molecules of ethylene oxide per molecule of starting material.

The product should prove of particular interest as an additive to mineral and vegetable oils intended for application to textile fibres, particularly when these oils have subsequently to be removed. The presence of these additives in the oils renders the oils far more easily removable from the fibres than would be the case if the additives were not there.

#### EXAMPLE 3.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 93½ parts by weight of ethylene oxide, using 1 part by weight of sodium methoxide catalyst, and employing substantially the same conditions of temperature and pressure and general procedure as in Example 1.

The oxyethylated product so made contained an average of approximately 8 molecular units of ethylene oxide per "molecule" of starting material. This new product was a soft brown wax, and could be readily dispersed (with foaming) in water to give a pale-yellow, finely dispersed emulsion of the oil-in-water type.

A viscous liquid emulsion is produced, which is suitable for use as a cosmetic lotion or the like, if the product of Example 3 is replaced for that of Example 1, in the formula for the preparation of the emulsion described after Example 1.

#### EXAMPLE 4.

100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 245 parts by weight of ethylene oxide, using 2 parts by weight of sodium methoxide catalyst, and employing substantially the same conditions of temperature and pressure and general procedure as in Example 1.

The oxyethylated product contained an average of approximately 21 molecular units of ethylene oxide per "molecule" of starting material. This new product was a soft wax.

of light brown colour, and could be readily dissolved (with foaming) in water to give a lemon-yellow slightly opalescent solution.

EXAMPLE 5.

5 100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 502 parts by weight of ethylene oxide, using 2 parts by weight of sodium methoxide catalyst, and employing substantially the same 10 conditions of temperature and pressure and general procedure as in Example 1.

The oxyethylated product contained an average of approximately 43 molecular units of ethylene oxide per "molecule" of starting 15 material. This new product was a wax, of light brown colour, and could be readily dissolved in water to give a clear lemon-yellow solution.

EXAMPLE 6.

20 100 parts by weight of "Hartolan" Grade wool wax alcohols mixture were reacted with 702 parts by weight of ethylene oxide, using 2 parts by weight of sodium methoxide catalyst, employing essentially the same procedure as in Example 1. 25

Materials produced according to Examples 1-6 will in general have uses as emulsifiers, wetting agents, dispersing agents, detergents, levelling agents in dyeing operations, 30 penetrants and solubilising agents. Their efficiency for a particular purpose is dependent to some extent upon the amount of ethylene oxide combined in the product, and, therefore, the material produced in accordance with one Example may be more suitable 35 for a given purpose than that in accordance with another. Even greater quantities of ethylene oxide may be combined with the wool wax alcohols and we do not limit ourselves to the quantities (i.e., ratio of oxide to 40 alcohols) given in the Examples.

The new derivatives of wool wax alcohols, except those of Examples 1 and 2, are insoluble or substantially insoluble in mineral 45 and vegetable oils but are either soluble or dispersible in water or in aqueous solutions; the products of Examples 1 and 2 are largely insoluble in water or aqueous solutions but

are substantially dispersible therein, and are also easily dispersible in oil. 50

One sees from these Examples that by increasing the ratio of ethylene oxide to wool wax alcohol one obtains products which pass from insolubility in water and solubility in oils to products which are completely and 55 readily soluble in water and nearly or totally insoluble in oils. The change occurs gradually, the intermediate range products being dispersible in water or forming emulsions with it. 60

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of improving the surface 65 active properties and/or solubility of the mixed wool wax alcohols which consists in reacting the same at elevated temperatures of the order of 130-170°C., with ethylene oxide, and the addition of a catalytically 70 active base such as sodium methoxide.

2. A method according to Claim 1, the amount of ethylene oxide used being dependent on the desired degree of solubility of the product. 75

3. A method according to Claim 1 or 2 using liquid ethylene oxide.

4. A method according to Claim 1 or 2 using liquid ethylene oxide added in stages.

5. A method according to Claim 1 or 2 80 using vapour of ethylene oxide.

6. A method according to any of the preceding Claims carried out under super-atmospheric pressure.

7. A method of improving the surface 85 active properties and/or solubility of the mixed wool wax alcohols substantially as in any of the Examples herein set forth.

8. Materials when produced by the method herein described and claimed. 90

Dated this 4th day of April, 1949.

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