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TREATMENT OF TEXTILE FIBERS

Augustus H. Gill, Belmont, Mass., assignor to The Gill Corporation, Cambridge, Mass., a corporation of Delaware

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This invention relates to the treatment of textile fibers of various kinds and in various forms, including the bulk starting fiber and the finished fabric.

In preparing such textile fiber as wool for the carding, spinning, weaving, and other textile-making operations, it is common practice to treat the bulk starting fiber with oils or oil emulsions which act as lubricants for the fiber and thereby facilitate the mechanical operations performed thereupon. It is also sometimes the practice to oil the finished fabric, for instance, finished wool or worsted goods, artificial silk fabrics, and others, for the purpose of imparting thereto such qualities as enhanced softness, weight, smoothness of feel, luster, etc. Many vegetable and animal oils present economical and technical advantages for such purpose, including the ease with which they can be emulsified and washed from the fiber, but some of the most attractive oils falling into this category are unstable in the sense that when applied to the fiber and exposed to atmospheric influences they rancidize and become malodorous or undergo oxidation into resinous or gummy products which not only cause trouble in the fabricating operations, but which are difficultly removable by ordinary washing. These observations apply not only to semi-drying oils, such as cottonseed and corn oil, but to non-drying oils, such as olive, lard and peanut oil. In the case of semi-drying oils, the oxidation may, in fact, be so bad and be accompanied by the liberation of so much heat as to render the bulk wool or other combustible fiber to which the oils are applied subject to the danger of spontaneous ignition and combustion.

In accordance with the present invention, non-drying or semi-drying oils are largely or substantially completely corrected prior to their application to textile fibers by a selective hydrogenation designed to transform the linoleic acid or its glyceride associated with such oils into oleic acid or its glyceride while preferably avoiding any substantial increase in the stearic acid or its glyceride content in the oils. In this connection, it is to be observed that the vegetable or animal oils to be corrected in accordance with my invention are all composed essentially of linoleic, oleic, stearic and palmitic acids, combined as glycerides or free. I have found that if any such oil is selectively hydrogenated to a stage where its linoleic acid content is largely transformed into oleic acid, the resulting oil changes much less upon exposure to the atmosphere and can be washed more easily and completely from the textile fibers or the finished goods to which it is applied. In applying the principles of the present invention to a non-drying oil, such as olive oil, which is quite low in its content of linoleic acid and so is not so troublesome as other non-drying oils or the semi-drying oils, the selective hydrogenation should be carried out to a stage where the major portion or practically all of the linoleic acid content of the oil has been transformed into oleic acid in order to effect a worthwhile improvement of the oil. In the case of semi-drying oils, such as cottonseed and corn oil, which are of comparatively high linoleic acid content, one need not necessarily convert all of the linoleic acid into oleic acid in order to improve the oil vastly for the purposes of the present invention. Indeed, by selectively hydrogenating semi-drying oils to a stage where they contain not more than about 4% linoleic acid, they are improved so greatly that they are even much better than are many non-drying oils, such as lard and peanut oil. In any case, however, it is preferable to hydrogenate the oil so as to convert practically all of its linoleic acid into oleic acid without, however, effecting any appreciable increase in the stearic acid content of the oil for the reason that stearic acid, being a solid, would cause an undesirable increase in the viscosity of the hydrogenated oil. Should the stearic acid and/or stearin, formed adventitiously during hydrogenation, or originating in the starting oil, or otherwise present in the hydrogenated oil, be in excess of that desirable from the standpoint of viscosity and the use to which the hydrogenated oil is to be put, such excess stearic acid and/or stearin may be removed from the hydrogenated product, thereby bringing it to the desired lower viscosity, as by chilling the hydrogenated product to freeze out the stearic acid and/or stearin and pressing out or otherwise separating the congealed stearic acid and/or stearin from the remaining liquid oil. Ordinarily, the stearic acid and/or stearin thus frozen out and separated from the hydrogenated product will be that formed as a result of hydrogenation so that the remaining liquid oil will have a fluidity corresponding substantially to that of the starting oil. In other words, the hydrogenation is preferably controlled and arrested at a point where increase in the viscosity of the oil such as would lower its value for the treatment of bulk textile fibers or the finished goods made therefrom is minimized; otherwise, the hydrogenated oil must be corrected or treated, as here-

inbefore described, to restore it to the desired condition of fluidity.

In performing the hydrogenating step of the present invention, I proceed in accordance with well known practice to combine hydrogen with the oil in the presence of a suitable catalyzer of hydrogenation. It is known that hydrogenation can be effected selectively, that is, in step-by-step fashion, so that the glycerides (mono, di, or tri) of the most unsaturated acid, as linolenic, are first changed to linoleic and then to oleic, before any substantial amount of saturated acid is formed. In accordance with the present invention, wherein the desired end-point of hydrogenation is that at which there is no material increase in the saturated fatty acid content of the oil, I arrest hydrogenation when the linoleic acid has been converted practically entirely into oleic acid or somewhat short of this end-point, depending upon the unsaturation of the oil used as the starting material and the degree to which hydrogenation must be carried in order to effect a worthwhile improvement in the oil. For instance, cottonseed oil having an iodine number of 109.8 may be hydrogenated in the presence of 0.2% finely divided nickel at 175° to 200° C., until its iodine number is 65.4. The hydrogenated oil thus produced contains 28.4% saturated fatty acids, 67.5% oleic acid (both iso and normal) and only 4.1% linoleic acid. If desired, hydrogenation may be continued until the linoleic acid content of the oil has been reduced to a negligible quantity. The hydrogenated oil can be used as such or, if necessary, blended with other suitable oils to the desired fluidity, in the treatment of textile fibers or finished textile goods of a woven, knitted, or felted character. In some instances, the hydrogenated oil as such or blended with other suitable oils may be emulsified in water in the presence of soap or other suitable emulsifying or stabilizing agent and the emulsion applied to the textile fibers or to the finished goods. Thus, the hydrogenated oil is readily emulsifiable in water containing a slight amount of ammonia, sodium carbonate, caustic soda, or other saponifying agent.

A hydrogenated oil composition prepared as hereinbefore described is particularly suitable for the preparation of "tops" which may be characterized as partially manufactured woolen yarn. The raw wool which goes into "tops" is washed, oiled as is customary in the preparation of woolen yarn, and made into a loose, rope-like structure of approximately an inch and a half in diameter. The "tops" are wound up in balls, weighing approximately two pounds, and are stored "in the grease", that is to say, with the oil upon them. If the oil be one which is subject to change, for instance, a semi-drying oil, it gums and makes trouble in the subsequent working up of the "tops" into yarn, causing a larger number of breaks and splits in the yarn than does a suitable oil. If, on the other hand, the oil used be one, for instance, a semi-drying oil, which has been hydrogenated in accordance with my invention so as to contain practically no linoleic acid glycerides, the foregoing troubles are minimized. Indeed, an olive oil which has been hydrogenated to a point where it is substantially devoid of linoleic acid or its glycerides becomes much better suited as a finishing oil, that is, for use in oiling down finished fabrics, e. g., artificial silk fabrics.

In the foregoing description, I have spoken above fatty acids and their glycerides interchangeably for the reason that for the purposes of my invention it makes no difference whether the fatty acid is present in the oil in free condition or combined as glycerides. Strictly speaking, the oils with which I am dealing herein usually comprise the glycerides as their preponderant components, but inasmuch as it is the fatty acid radicals that are undergoing transformation by hydrogenation, rather than the glycerol-radical, I have stressed the fatty acid aspect of the oils. In the appended claims, I shall for convenience refer only to the fatty acid content of the oil, meaning thereby, however, both free fatty acid and fatty acid combined as glycerides.

I claim:—

1. A process of preparing for textile fiber treatment a fatty acid oil associated with linoleic acid, which comprises selectively hydrogenating said oil to a stage where substantially only the linoleic acid has been largely transformed into oleic acid, thereby substantially preserving the fluidity of the oil for fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber.

2. A process of preparing for textile fiber treatment a semi-drying oil associated with linoleic acid, which comprises selectively hydrogenating such oil to a stage where not more than about 4% linoleic acid is present in the oil whereas the other fatty acids remain substantially unaffected, thereby substantially preserving the fluidity of the oil for fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber.

3. A process of preparing cottonseed oil for textile fiber treatment, which comprises selectively hydrogenating said oil to a stage where it contains not more than about 4% linoleic acid whereas its other fatty acids remain substantially unaffected, thereby substantially preserving the fluidity of the oil for fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber.

4. A process of preparing olive oil for textile fiber treatment, which comprises selectively hydrogenating said oil until its linoleic acid content is substantially destroyed whereas its other fatty acids remain substantially unaffected, thereby substantially preserving the fluidty of the oil for fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber.

5. A process of preparing for textile fiber treatment a fatty acid oil associated with linoleic acid, which comprises selectively hydrogenating said oil to a stage where linoleic acid has been largely transformed into oleic acid, and removing from the hydrogenated oil stearic acid originating in the starting oil and formed therein by hydrogenation, thereby producing an oil of a fluidity satisfactory for the fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber.

6. A process of preparing for textile fiber treatment a fatty acid oil associated with linoleic acid which comprises selectively hydrogenating said oil to a stage where linoleic acid has been largely transformed into oleic acid, and freezing out and separating from the hydrogenated oil such stearic acid as may be formed therein during hydrogenation, thereby producing an oil of a fluidity satisfactory for the fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber.

7. A process of preparing for textile fiber treatment a fatty acid oil associated with linoleic acid,

which comprises selectively hydrogenating said oil to a stage where linoleic acid has been largely transformed into oleic acid, and freezing out and separating from the hydrogenated oil such normally solid bodies as may be formed therein during hydrogenation, thereby producing an oil of a fluidity satisfactory for the fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber.

8. A process of preparing for textile fiber treatment a fatty acid oil associated with linoleic acid, which comprises selectively hydrogenating said oil to a stage where substantially only the linoleic acid has been largely transformed into oleic acid, thereby substantially preserving the fluidity of the oil for the fiber treatment while largely eliminating therefrom a constituent that tends to gum on the fiber, and emulsifying the resulting hydrogenated oil in water in presence of an emulsifying agent.

AUGUSTUS H. GILL.