Patented June 10, 1952

2,599,590

UNITED STATES PATENT OFFICE

2,599,590

PROCESS FOR RENDERING PROTEINACEOUS TEXTILE MATERIALS WATER REPELLENT

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No Drawing. Application July 28, 1948, Serial No. 41,183

4 Claims. (Cl. 117—141)

1

This invention relates to a process for rendering proteinaceous textile materials water repellent, and more particularly to a process for rendering wool fabrics water repellent by the application thereto of very dilute solutions of soap and of aluminum salt.

An object of the invention is to provide a process for conferring water repellency on proteinaceous textiles such as wool, silk, and synthetic protein fabrics. A further object is to provide a process which may be used to restore water repellency to fabrics, the water repellent finish of which has been deteriorated by laundering or dry cleaning. The process may be reapplied to the same fabric as many times as may be desired, when retreatment is necessary, with the production of an excellent finish each time. The process is also applicable to wool fabrics which have been subjected to chlorination or other shrinkproofing treatment.

Another object of the invention is to provide an improved process for rendering proteinaceous textile materials water repllent, which process is characterized by extreme simplicity of operation and economy of time, labor and materials.

A further object is to provide a process for producing water repellent proteinaceous fabrics having unimpaired hand or feel and exhibiting no undesirable harshness or boardiness. Fabrics treated in accordance with the process have excellent spray ratings and dynamic absorption values when tested for these properties as described in Fed. Spec. CCC-T-191*a*.

Another object of the invention is to provide a process for rendering woolen felts water repellent without adversely affecting their flexibility or handle.

Typically, the process of the invention includes applying to a proteinaceous textile material, in fabric, skein, yarn, felt, or other convenient form, an aqueous solution of a water-soluble fatty acid soap in a concentration of from 0.01% to 1.0% and thereafter applying to the material a water-soluble aluminum salt in a concentration of from 0.05% to 1.0%.

Preferably, the proteinaceous textile material is first immersed in an aqueous solution of a fatty acid soap in a concentration of less than about 0.5%, a concentration of about 0.25% being characteristic, and is agitated therein for a period of from about 5 minutes to about 15 minutes, the temperature of the bath being kept at about 70° F. to 140° F. The thus treated material is then removed from the soap bath and is rinsed in warm water to remove any excess soap. Thereafter, the rinsed, soap treated material is immersed in a second bath comprising an aqueous solution of an aluminum salt in a concentration of from about 0.05% to 1.0% and agitated therein for a period of from about 3 minutes to about 5 minutes, the temperature of the bath being maintained at from 70° F. to 140° F. Finally, the material is rinsed in warm water and dried.

2

The soap treating bath may include either high or low titer water-soluble fatty acid soap, or salts of fatty acids such as sodium stearate, sodium oleate, sodium myristate, ammonium oleate, potassium stearate, and the like, and mixtures thereof. The term "fatty acid soap" is used in the claims in a broad sense and is intended to include the foregoing and their equivalents. The soap solution should have a soap concentration of less than about 1.0%, the low range of concentrations of from 0.01% to 0.25% giving very good results. The preferred weight ratio of the bath to the material being treated is about 20 to 1. The bath temperature is kept at a point at which the soap is soluble and at which danger of felting the material being treated is minimized. In general, temperatures of from 70° F. to 110° F. are preferred. Agitation is desirable and the period of treatment may run from 5 to 15 minutes, although a longer period will do no harm. The time of treatment is not critical and will be dependent on the ease of wetting of the particular material being treated.

The soap treated material, after rinsing, is found to have picked up from about 0.2% to about 0.6% of soap by weight based on the weight of the fabric.

The aluminum salt baths of the invention include aqueous solutions of water-soluble aluminum salts such as the sulfate, acetate, nitrate, chloride, formate and other simple salts of aluminum. It may also include various alums such as ammonium alum, potash alum, sodium alum and the like. The term "aluminum salt" as used herein is intended to include without limitation the simple water-soluble aluminum salts and alums.

We have found that the use of very low concentrations of aluminum salt confers unexpectedly good water repellency to proteinaceous textiles such as wool when treated in accordance with our process. An aqueous solution containing about 0.1% of aluminum salt is considered optimum, although concentrations of from 0.05% to 0.25% give excellent results. A solution containing as little as 0.02% aluminum salt produces a satisfactory finish in some cases and we have also

found that solutions as concentrated as 1.0% may sometimes be used. However, baths containing more aluminum salt than about 1.0% produce inferior products.

Treatment in the aluminum salt bath may be carried out similarly to treatment in the soap bath. The weight of the bath is preferably about 20 times the weight of material treated. The bath is kept at a safe non-felting temperature of about 70° F. to 140° F. The time of treatment may be from about 3 minutes to about 5 minutes, although longer times may be employed. The time may be as little as one minute or as long as necessary to produce good penetration. The time of treatment is not critical and is dependent on the type of material being treated, as well as on the equipment used. For example, using padding equipment, short treating times are suitable, whereas immersion treatments require long periods of time.

Wool fabrics, when treated in accordance with the present process, acquire an add-on of about 0.2% to 0.6% by weight of the dry fabric. The added substance contains approximately 0.1% or less of aluminum on the basis of the dry fabric, the remainder being fatty acid. Thus, it is seen that a relatively low add-on treatment is provided with the production of excellent water repellency.

Although we do not wish to be restricted to any theory, it is our belief that the protein molecule of the fabric binds both fatty acid and aluminum with the formation of a complex which is probably responsible for the water resistance obtained.

In order to further illustrate the method of the invention, the following examples are given:

Example I

Wool fabric is agitated in 0.25% high titer soap solution for 15 minutes at 100° F., after which it is rinsed, and agitated in a solution of 0.1% aluminum sulfate octadecahydrate for 5 minutes at 100° F. (20:1 bath is satisfactory). The fabric is then rinsed and dried at 125° F. The fabric acquires an excellent water repellent finish by this treatment.

Example II

A blended synthetic protein fabric (50% cellulose acetate-50% protein fiber) is passed through 0.25% low titer soap solution, rinsed, and agitated in 0.1% aluminum sulfate octadecahydrate for 5 minutes, then rinsed and dried at 130° F. The fabric no longer puckers on exposure to drops of water.

Example III

Two pounds of shrinkproof woolen fabric is treated in a wash wheel with 0.25% high titer soap at 100° F. for 15 minutes, followed by rinsing, and treatment with 0.1% aluminum sulfate octadeca-hydrate at 100° F. (20:1 bath) for 5 minutes. The fabric is then rinsed, hydroextracted, and dried in a tumble drier at 135° F. The fabric is made water repellent by the treatment.

Example IV

A wool fabric is agitated in 0.25% high titer soap solution for 15 minutes at 100° F., rinsed once with water, and then treated in a solution of 0.1% aluminum acetate for 5 minutes at 100° F. A 20:1 bath to goods ratio is satisfactory for these operations. The fabric is then rinsed and dried at 125° F. An excellent water repellent finish is obtained by this treatment.

Example V

A wool fabric is treated in a bath containing 0.3% high titer soap solution for 15 minutes at 100° F., rinsed once with water, and then passed into a bath of 0.1% aluminum sulfate maintained at 135° F. The fabric is treated in this bath for 10 minutes and dried without rinsing. An excellent water repellent finish is obtained by this treatment.

Example VI

Wool felt is treated in a 0.3% solution of high titer soap at 110° F. for 10 minutes, passed through squeeze rolls, and then, without rinsing, treated in a 1% solution of aluminum sulfate at 135° F. for 15 to 20 minutes. The felt is then passed through squeeze rolls and dried. A water repellent felt of excellent hand is produced in this manner.

The rendering of woolen felts water repellent by this treatment is particularly advantageous over conventional treatments. Wool felts are often used in low temperature areas, such as in the Arctic, for protective purposes. They are also used under low temperature conditions for industrial applications. At these temperatures the maintenance of flexibility is an important property. Felts treated by this process remain flexible in the dry state because of low add-on and lack of brittle finishes. They also remain flexible in the wet state because only small amounts of water, which subsequently freeze, are absorbed. On the other hand, felts treated with conventional aluminum-wax finishes have higher add-ons, and these felts lose their flexibility, and become very stiff, either wet or dry, at low temperatures. On bending, such materials actually break apart. Felts treated by the process of the invention as herein described are advantageously employed in such low temperature applications.

Because of the low add-on nature of the treatment, the handle and air permeability of treated fabrics is not impaired. The use of larger amounts of aluminum salt clogs the pores of fabrics, and also results in a tacky handle. It has been found that this tacky handle is averted when the concentration of soap on the fabric is within the limits described herein.

Where particular hydrates of aluminum salts are referred to herein it will be understood that the equivalent weight of the anhydrous salt or other hydrate may be used instead.

While we prefer to employ our soap and aluminum salt baths in the ratio of about 20 parts by weight of each to 1 part by weight of the proteinaceous textile material, we may vary this ratio within the limits of about 10 parts to 30 or more parts by weight of the bath to one part by weight of the textile material. Non-soap detergents may be added to the soap or the aluminum salt baths to obtain improved wetting and penetration.

From the foregoing description it will be seen that the present invention provides a process for conferring water repellency to proteinaceous textile materials such as wool, silk or synthetic protein textile fabrics and the like or mixtures including the same. Certain fabrics which wet rapidly and pucker do not exhibit such deficiencies after treatment by this process.

A wide variety of woolen fabrics of different construction such as serge, flannels, meltons, tropical worsteds, napped blankets, covert, and

tightly woven worsteds show greatly improved water resistance after treatment by the process. Woolen felts may also be rendered water repellent by this process. Treated felts acquire a soft handle as a result of the treatment.

The finish produced by the process of the invention is "semi-durable" to laundering and dry cleaning. However, the treatment can be readily re-applied to fabrics if the finish has become deteriorated through wear and repeated launderings or dry cleanings.

We have found that it is not essential to rinse the material between the soap and aluminum salt treatments. The material may be merely squeezed or wrung after it has been soaped and then immediately subjected to the aluminum salt treatment; or it may be rinsed as many as two or three times between the soap and aluminum salt baths without detracting from the quality of the finish produced.

This application is a continuation-in-part of our co-pending application Serial No. 713,916, filed December 4, 1946, now abandoned, for Process for Rendering Proteinaceous Textile Materials Water Repellent.

We claim:

1. Process for rendering proteinaceous textile materials water repellent which comprises applying to the proteinaceous textile material an aqueous solution of a water-soluble fatty acid soap in a concentration of about 0.25% and thereafter applying to the material an aqueous solution of a water-soluble aluminum salt in a concentration of about 0.1%.

2. Process for rendering wool textile fabrics water repellent which comprises immersing the fabric in an aqueous solution of a water-soluble fatty acid soap in a concentration of about 0.25% and at a temperature of about 70° F. to 110° F., and agitating the fabric in said solution for a time sufficient to provide substantial penetration of the fabric by the solution; rinsing the fabric in warm water to remove excess soap; immersing

the thus treated fabric in an aqueous solution of aluminum sulfate in a concentration of about 0.1% and at a temperature of about 70° F. to 140° F., and agitating the fabric in said second solution for a time sufficient to provide substantial penetration of the fabric by the solution; the weight ratio of said solutions to said fabric being about 20 to 1; rinsing the fabric in warm water; and drying the fabric.

3. Process for rendering proteinaceous textile materials water repellent which comprises applying to the proteinaceous material an aqueous solution of a water-soluble fatty acid soap in a concentration of about 0.25% and thereafter applying to the material an aqueous solution of aluminum sulfate in a concentration of about 0.1%

4. Process for rendering proteinaceous textile materials water repellent which comprises applying to the proteinaceous material an aqueous solution of a water-soluble fatty acid soap in a concentration of about 0.25% and thereafter applying to the material an aqueous solution of aluminum acetate in a concentration of about 0.1%.

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