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WASHING COTTON FABRICS

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The present invention relates to washing cotton fabrics and more particularly to an improvement in washing cotton fabrics whereby the useful life of the fabric is increased by decreasing the loss in strength of the fabric after repeated washings.

It has been known that repeated washing of cotton garments results in a gradual decrease in the strength of the cotton fabric. It also has been known that repeated washings in water containing iron results in iron deposits on the fabrics which discolor the fabric and contribute to lower strength.

The present invention is based upon the postulation that the loss of strength in cotton fabric resulting from repeated washings may be due to a change in the structure of the cellulose molecule and that the presence of iron deposits may accentuate this change by catalytic degradation. The invention is based further upon the conceptions that since the alkali metal borohydrides are powerful reducing and hydrogenating agents, the presence of a small amount of an alkali metal borohydride in the wash bath might tend to prevent degradation of the cellulose molecule and tend to maintain the iron present in a wash bath in its reduced and soluble form.

Subsequent investigations have proved that after a cotton fabric has been subjected to repeated washings in a wash bath containing conventional detergents together with a small amount of an alkali metal borohydride, the strength of the fabric is substantially greater than that of a cotton fabric which has been subjected to the same number of washings in a wash bath containing the same conventional detergents but no alkali metal borohydride.

Thus, the present invention provides a novel aqueous bath which may be used advantageously in washing cotton fabrics. The bath of the invention may be of any conventional composition except that it also contains as an essential ingredient a small amount of an alkali metal borohydride, such as sodium borohydride or potassium borohydride. Since these alkali metal borohydrides tesd to decompose gradually in aqueous solution, a small amount of an alkaline material, such as sodium hydroxide, potassium hydroxide, ammonium hydroxide, sodium or potassium carbonate, trisodium or tripotassium phosphate, etc., is dissolved in the bath to act as a stabilizing agent for the borohydride. The bath is equally useful for preventing deterioration of rayon fabrics when subjected to repeated washings.

A typical conventional aqueous washing bath comprises water containing soap or synthetic detergent in an amount of about 700 parts by weight per million parts of the bath. It often contains a water softener or sequestering agent in an amount up to about 350 parts by weight per million parts of the bath. It also sometimes contains a bleaching agent, such as sodium hypochlorite.

The aqueous bath of the invention consists essentially of water having dissolved therein a conventional detergent in conventional amount with or without a conventional amount of a water softener together with from about 3.5 to 17.5 parts by weight of an alkali metal borohydride and from about 7 to 35 parts by weight of an alkali metal hydroxide per million parts by weight of the bath. Preferably, the bath of the invention contains about 9 parts by weight of alkali metal borohydride and about 18 parts by weight of an alkali metal hydroxide per million parts of the bath.

As typical of conventional detergents I may mention sodium oleate, sodium palmitate and sodium stearate soaps as well as mixtures thereof and special soaps such as olive oil soaps, cocoanut soaps, rosin fatty acid soaps, etc. As typical of conventional synthetic detergents I may mention sodium dodecyl benzene sulfonate, sodium lauryl sulfate, sodium oleyl sulfate, sodium stearyl sulfate, sodium dioctyl sulfosuccinate, sodium N-methyl-N-palmitoyl taurate, sodium alkyl naphthalene sulfonate, polyethylene glycol-tert-dodecyl thioether, polyoxyethylene abietic ether, triethanolamine palmitate, triethanolamine oleate and polyethylene ethers of lauryl, stearyl and oleyl alcohols. As typical of conventional water softeners or sequestering agents I may mention sodium hexametaphosphate, sodium tripolyphosphate, tetrasodium pyrophosphate, ethylene diamine tetraacetic acid and its mono, di and tri-sodium salts.

In order to illustrate the invention further and compare the results obtained with the bath of the invention with the results obtained with typical previously used baths, the following tests are given. In these tests the following wash formulations were used.

Regular Wash

Component	Amount	Parts by Weight per Million Parts by weight of bath
Sodium oleate	20 grams	705
Sodium hexametaphosphate	10 grams	352.5
Sodium hydroxide	1 gram	35
Water	7.5 gallons	
pH of bath 8.8		

Bleach Wash

Component	Amount	Parts by Weight per Million Parts by weight of bath
Sodium oleate	20 grams	705
Sodium hexametaphosphate	10 grams	352.5
Sodium hypochlorite	4 ounces	3968.65
Water	7.5 gallons	
pH of bath 9.0		

Borohydride Wash

Component	Amount	Parts by Weight per Million Parts by weight of bath
Sodium oleate	20 grams	705
Sodium hexametaphosphate	10 grams	352.5
Sodium borohydride	0.25 grams	8.75
Sodium hydroxide	0.50 grams	17.5
Water	7.5 gallons	
pH of bath 9.3		

A separate sample of standard white broadcloth measuring 1 yard by 1½ yards was subjected to 70 complete washing cycles in the above in a bath of each of the above compositions. All washings were conducted in a standard "Laundromat" using the full washing cycle on the hot setting, namely, the washing cycle was 20 minutes at approximately 150° F., followed by three rinses and a final spin-drying cycle. Each sample was laundered once each day and allowed to remain dry overnight until the resumption of the next laundering cycle. Each sample was dried in a standard electrically heated tumble drier using the medium setting.

The samples of broadcloth used were insufficient to yield an adequate load for the washing machine and, therefore, approximately 7 pounds of additional ballast was added to the washer so that the washing cycle would be reasonably typical of a family wash.

As the washing cycles progressed, it was noted that the

samples in the regular wash and in the bleach wash gradually became yellower whereas no appreciable yellowing of the borohydride wash sample occurred. This is attributed to the fact that the borohydride keeps any iron present in its soluble form so that little or no iron deposition occurs to accentuate degradation of the cellulose molecule.

At the end of the 40th, 50th, 60th and 70th cycles of laundering, test pieces were removed from the main samples for analysis. Instron strip tensile tests were run in the warp direction as a measure of strength change, the results being shown in the following table.

Instron Tensile in Lbs./In.

Type of Wash	Number of Wash Cycles			
	40	50	60	70
Regular Wash	64.8	60.1	51.8	46.3
Bleach Wash	53.0	53.2	46.6	44.4
Borohydride Wash	66.7	61.5	60.8	57.0

I claim:

1. In the washing of cotton and rayon fabrics wherein the fabric is subjected to a washing operation in an aqueous solution of a detergent whereby repeated washings result in loss of strength of said fabric, the improvement

whereby said loss of strength is decreased by dissolving in said aqueous solution in parts by weight per million parts by weight of said solution about 3.5 to 17.5 parts of a borohydride selected from the group consisting of sodium borohydride and potassium borohydride and from about 7 to 35 parts of an alkaline material for stabilizing the borohydride.

2. The method as defined in claim 1 wherein said borohydride is sodium borohydride.

3. The method as defined in claim 2 wherein the amount of sodium borohydride is about 8.75 parts.

4. The method as defined in claim 3 wherein the alkaline material is sodium hydroxide in an amount of about 17.5 parts.

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