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FIBROUS MATERIAL AND PROCESS OF MAKING SAME

No Drawing. Application filed July 27, 1929, Serial No. 381,688, and in Switzerland August 8, 1928.

The present invention relates to new fibrous materials. It comprises the manufacture of the new fibrous materials, the fibrous materials themselves, and the application thereof in the textile industry, such as for instance for the production of mixed fabrics and multi-colored materials.

It has been found that quite generally new dyeing properties are imparted to fibrous materials of vegetable, animal, or artificial origin, by treating these materials with organic isocyanates of the general formula $R.N=C=O$, wherein R is any organic residue in the absence of solvents.

Such organic isocyanates are for example the phenylisocyanates, the naphthyl-isocyanates, the nitro-phenyl-isocyanates, further aliphatic isocyanates, such as the methyl or ethyl-isocyanates.

This method is particularly valuable for the treatment of such fibers which, contrary to cellulose ethers and esters, are dyed without difficulty with dyestuffs containing more than one sulfo group. Such fibers are for instance the fibers of vegetable origin, such as cotton, linen, jute, ramie, etc., further the artificial fibers from so-called regenerated cellulose (viscose silk and cuprammonium silk), and the fibers of animal origin, such as wool and silk.

For example, by the action of phenylisocyanate on vegetable fiber, such as cotton, in the piece or in the form of yarn, there is obtained a product whose outer structure is retained but whose properties in respect of dyestuffs have been profoundly changed. By this treatment the cotton loses its affinity to substantive cotton dyestuffs while it is easily dyed by acetate silk dyesuffs, for instance by insoluble azo-dyestuffs and amino-anthraquinones. Like cotton or other vegetable fibers, animal fibers, such as wool and silk, can also be treated with isocyanates with retention of their structure but with profound change in the behavior of the treated material towards dyestuffs. Wool loses its affinity for the typical wool dyestuffs.

The treatment of fibrous materials with organic isocyanates may be performed by saturating the previously dried goods with the isocyanate and allowing them to remain therein at the ordinary temperature or at a raised temperature. Catalysts, such as pyridine, zinc chloride or the like, may be added.

The new products are suitable in loose form, as yarn or web, for obtaining many effects due to their changed relationship to dyestuffs. In particular such yarns may be interwoven with untreated yarn, so that by subsequent dyeing or printing with dyestuffs one or other of the fibers is dyed; or by suitable choice of dyestuff and dyeing process or printing process multi-colored materials are obtained. The possibility of producing such effects even exists in the case of piece goods, if the latter have been treated locally with an isocyanate.

From the process described in the specification No. 1,357,450 the present invention is distinguished in that the fibrous materials treated are only affected insofar as their physical and chemical properties are concerned, their fibrous structure remaining unchanged, whereas in the known process the purpose was the dissolution of the cellulose and its reprecipitation in the form of a carbamic acid ester. Moreover, the present invention is not limited to cellulose but is applicable also to animal fibers.

The following examples illustrate the invention:—

Example 1

Cotton yarn which has been dried in a vacuum is immersed in phenylisocyanate with addition of a small proportion of pyridine and the whole is heated to 80° C. After 4 hours the excess of isocyanate is distilled in a vacuum and the yarn is freed by washing with hot alcohol from the residual pyridine and from some diphenyl-urea which has been formed. The yarn is externally unchanged but has increased in weight up to 30 per cent. and has a nitrogen content of 2.5 per cent. It is strongly dyed by basic dyestuffs without a mordant. Also by acetate silk dyestuffs the mode of dyeing being similar to that usual for this fiber, whereas direct dyestuffs are scarcely absorbed.

Example 2

Cotton yarn is introduced into a mixture of 90 parts of phenylisocyanate and 10 parts of pyridine. The mixture is allowed to stand for 4 days and then the excess of phenylisocyanate and pyridine is separated by distillation in a vacuum or by centrifuging. The yarn is finally washed with hot alcohol.

Example 3

Woolen yarn which has been dried in a vacuum is saturated with phenylisocyanate so that it contains an equal weight thereof and heated for 48 hours in the water-bath with exclusion of moisture. The yarn is then boiled with alcohol, whereby a product is obtained whose structure is unaltered and which has suffered a considerable increase in weight, for instance up to 50 per cent. This yarn is no longer dyed by acid dyestuffs, such as dyestuff No. 66, Schultz, Farbstofftabellen, 6th Edition.

Example 4

The fiber, treated as described in Example 1, is mixed with 4 parts of untreated cotton and dyed in a dye-bath prepared with 2 per cent. of direct dyestuff (such as No. 424, Schultz, Farbstofftabellen, 5th Edition) and 30 per cent. of Glauber's salt (calculated on the total weight of the fibrous material), the dyeing being continued for 1 hour at 90° C. Whereas the cotton is dyed as usual a powerful blue, the treated fibers remain nearly white.

Example 5

A dye-bath is prepared which contains 2 grams of soap per litre, and 1 per cent. of acetate silk dyestuff, such as 1:4-diaminoanthraquinone, in fine suspension, and the goods treated as described in Example 1 are dyed for an hour at 80–90° C. in the bath. There is obtained a powerful red-violet dyeing, whereas cotton is not dyed by this treatment.

Example 6

Goods treated as described in Example 1 are entered into a dye-bath which contains 1 per cent of solid green and 1 per cent. of acetic acid of 40 per cent, strength, and after ¼ hour the temperature of the bath is gradually raised to 70° C. There is obtained a powerful green dyeing.

Example 7

Wool fiber, treated as described in Example 3, remains undyed when, in admixture with the same quantity of untreated wool, it is introduced into a dye-bath containing 2 per cent. of acid-dyestuff (for example para-aminoacetanilide→acetyl-H-acid, Schultz, 5th Edition, No. 66), 10 per cent. of Glauber's salt and 2 per cent. of sulfuric acid at 66° Bé. at 90–95° C. the treatment lasting for 1 hour. The wool, on the other hand, is dyed a deep blue red.

What I claim is:—

1. Process of altering the chemical properties of natural fibrous materials, comprising treating fibrous materials with organic isocyanates in the absence of solvents.

2. Process of altering the chemical properties of natural fibrous materials, consisting in treating fibrous materials with organic isocyanates in the absence of solvents and in the presence of a tertiary base as catalyst.

3. Process of altering the chemical properties of natural fibrous materials, comprising treating with organic isocyanates in the absence of solvents such fibers which, contrary to esters and ethers of cellulose, can be dyed without difficulty with dyestuffs containing more than one sulfo group.

4. Process of altering the chemical properties of natural fibrous materials, consisting in treating with organic isocyanates in the absence of solvents and in presence of a tertiary base as catalyst such fibers which, contrary to esters and ethers of cellulose, can be dyed without difficulty with dyestuffs containing more than one sulfo group.

5. Process of altering the chemical properties of natural fibrous materials, comprising treating fibers of vegetable origin which, contrary to esters and ethers of cellulose, can be dyed without difficulty with dyestuffs containing more than one sulfo group, with organic isocynates in the absence of solvents.

6. Process of altering the chemical properties of natural fibrous materials, consisting in treating fibers of vegetable origin which, contrary to esters and ethers of cellulose can be dyed without difficulty with dyestuffs containing more than one sulfo group, with organic isocynates in the absence of solvents and in presence of a tertiary base as catalyst.

7. Process of altering the chemical properties of natural fibrous materials, comprising treating cotton with organic isocyanates in the absence of solvents.

8. Process of altering the chemical properties of natural fibrous materials, consisting in treating cotton with organic isocyanates in the absence of solvents and in presence of a tertiary base as catalyst.

9. Process of altering the chemical properties of natural fibrous materials, comprising treating cotton with phenyl-isocyanate in the absence of solvents.

10. Process of altering the chemical properties of natural fibrous materials, consisting in treating cotton with phenyl-isocyanate in the absence of solvents and in presence of a tertiary base as catalyst.

In witness whereof I have hereunto signed my name this 18th day of July, 1929.

MAX HARTMANN.