United States Patent Office 2,917,410 Patented Dec. 15, 1959

2,917,410

POLYGLYCOL-POLYACID ESTER TREATMENT OF TEXTILES

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No Drawing. Application June 20, 1955
Serial No. 516,755
22 Claims. (Cl. 117—138.8)

This invention relates to the treatment of textile fibers of all varieties with the esters of polyalkylene glycols or their monoesters or monoethers with certain polyacids and to the resulting impregnated textile articles.

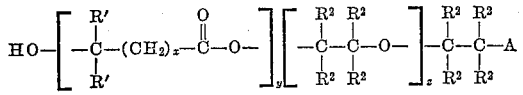
An object of the invention is to provide fibrous textile materials of improved strength or resistance to wear.

Another object of the invention is to provide a treatment which enhances the strength or wearing qualities of fibrous textile materials.

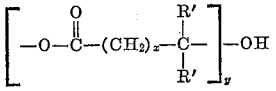
Other objects and advantages of the present invention will be apparent to those skilled in the art from the detailed disclosure hereinbelow.

The present invention is concerned with fibrous textile materials impregnated with one or more esters of a polymerized aliphatic monohydroxy monocarboxylic acid with an alcohol of the group consisting of polyalkylene glycols, monoesters thereof, and monoethers thereof, as well as with the impregnating process. Narrower aspects of the invention involve the preferred types of esters, the preferred constituents thereof, and those fibers which are susceptible to outstanding improvement.

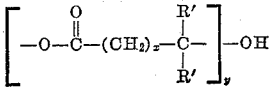
The novel compounds comprise esters or ether-esters of high molecular weights ranging from about 400 to about 225,000 containing a polyoxyalkylene chain having a molecular weight between about 200 and about 25,000 with a polyacid residue chain or chains with molecular weights totalling between about 200 and about 200,000 attached at one or at both ends of the polyoxyalkylene chain. This group of compounds is probably best illustrated by the following formula:



where R′ is of the group consisting of hydrogen and alkyl radicals; R^2 is of the group consisting of hydrogen, aryl, and lower alkyl radicals; A is of the group consisting of hydroxyl, alkoxy, cycloalkoxy, aralkoxy, araloxy, monoacyloxy and



radicals; x is 0 or a positive integer, y is an integer greater than 1 and z is an integer greater than 2. It will, of course, be realized that the values of x, y, and z are only whole numbers in the case of an individual compound and that mixtures are usually involved in which these values are expressed in decimals which represent the average values for the various proportions of individual compounds present in the mixture. When in the above formula A represents a hydroxyl group, the compound is a monoester; when it is a



radical the compound is a diester; when A designates a monoacyloxy group, the compound is a mixed ester; and when A stands for an oxygenated hydrocarbon radical, such as an alkoxy group, the compound is a monoether-monoester. It is to be emphasized that the polyoxyalkylene chain is not interrupted by carboxylic acid residues but that the latter form either one or two also uninterrupted chains which are attached at one or both ends of the polyoxyalkylene radical.

In preparing the compounds used in the present invention, a wide variety of monohydroxy monocarboxylic aliphatic acids or their anhydrides, lactones, lactides or esters may be employed; and the position of the single hydroxyl radical on the carbon chain of the acid is not important. Thus, a wide variety of alpha, beta, gamma, delta, etc., hydroxy-substituted acids or derivatives is suitable, including glycolic, lactic, β-hydroxypropionic (hydracrylic), α-hydroxyisobutyric, β-hydroxyisobutyric, α-hydroxybutyric, β-hydroxybutyric, α-hydroxyvaleric, α-hydroxycaproic, α-hydroxyisovaleric, hydroxypivalic, 12-hydroxyoctadecanoic, lactyllactic, and ω-hydroxypalmitic acids; ethyl lactate, lactide, δ-caprolactone, γ-stearolactone, β-propionolactone, γ-butyrolactone, δ-valerolactone, and the lactone of ω-hydroxypentadecanoic acid. The condensation polymers formed from these monomeric acids may be substituted as reactants and such a polyacid must be employed when a monoester of a polyacid and a polyalkylene glycol is produced unless there is an ether or ester group already blocking one end of the polyglycol. Polyhydroxy acids are not equivalents of monohydroxy acids of the type indicated, inasmuch as the polyhydroxy acids tend to cross-link; and cross-linking appears undesirable for the present purposes.

The expression "ester" in connection with various acids is used broadly herein to indicate the acid and other residues present in the product esters and not their source; that is, not to limit the products to any method of preparation or reactants employed therein. For example, an ester of a polymerized lactic acid and a polyethylene glycol is intended to include esters prepared from monomeric lactic acid, monomeric ethyl lactate, polymerized methyl lactate, lactide, lactones or polylactic acid, as well as any other reactants capable of forming a polylactic acid residue or radical in the ester.

Of the polyalkylene glycols, polyethylene glycol is greatly preferred due to its low cost and ready availability and especially where the higher molecular weight water-soluble esters are concerned. However, in the type formula given above, each R^2 substituent of the polyoxyalkylene residue may be a 1 to 4 carbon alkyl group such as methyl, ethyl, propyl, and isopropyl or the various normal and isomeric butyl groups, as well as a phenyl radical or hydrogen. Among the many other useful polyglycols are polypropylene glycol, 1,2-polybutylene glycol, 2,3-polybutylene gycol, polyisobutylene glycol, and polyphenylethylene glycol.

Monoethers of the same polyalkylene glycols may be used in lieu of the polyalkylene glycol reactant. The resulting products in this case are ether-esters. A wide variety of the ethers are operative as reactants, as for instance, alkyl ethers, cycloalkyl ethers, aralkyl ethers and aryl ethers of the polyalkylene glycols. Among the myriad of these ethers, a few illustrative species include methoxypolyethylene glycol, butoxypolypropylene glycol and ethers having a single propoxy isobutoxy, lauryloxy, phenoxy, benzyloxy, phenylethoxy, stearyloxy, naphthoxy, p-chlorophenoxy, t-octylphenoxy, etc., group replacing the hydroxyl group at one end of a polyethylene, polypropylene, polybutylene, polyisobutylene, and polyphenylethylene glycol chain.

Other suitable agents are a group of mixed esters of