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## ACID-MODIFIED POLY(VINYL ACETATE-VINYL PROPIONATE) TEXTILE

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### ABSTRACT OF THE DISCLOSURE

Disclosed herein are acid-modified poly(vinyl acetate-vinyl propionate) textile sizes and textiles sized therewith.

### FIELD OF INVENTION

The present invention relates to textile sizes. More particularly it relates to acid-modified poly(vinyl acetate-vinyl propionate) textile sizes and to textiles, especially polyester textiles sized with these materials.

### PRIOR ART

In conventional loom operations yarn is sized with an aqueous solution of a water soluble material such as a copolymer of vinyl acetate and a carboxylic acid, woven into cloth on a conventional loom with a mechanical shuttle and then the size is removed in a water bath. While these sizes have been adequate for natural textile fibers and for many of the synthetic textile fibers, they exhibit poor adhesion to synthetic fibers, particularly to polyester fibers which are enjoying increasing use in broadwoven textiles. Interpolymers of vinyl acetate and maleates have better adhesion to polyester but insufficient to prevent shedding from the yarn, leaving it unprotected from the destructive forces of the loom. Acrylate sizes have good adhesion to polyester but lack the strength to hold the monofilaments together sufficiently to withstand the disruptive forces of the loom. This weakness may be overcome in an unsatisfactory fashion by heavier coatings of size but costs rise because of the heavier consumption of size and more importantly, because of frequent interruptions to repair breaks of the wrap caused by deposition and accumulation of size on the heddles and reeds of the loom. Other sizes such as poly(vinyl alcohols), styrene maleic anhydride copolymers, poly(acrylic acids) and gelatin are extremely poor in adhesion to polyester.

Thus, there exists in the art a need for a textile size with adequate adhesion to synthetic yarns and in particular to polyester yarn, and with improved physical properties such as tensile strength, elongation and toughness, and solubility in aqueous and organic media.

### SUMMARY OF THE INVENTION

The above-mentioned need in the prior art is fulfilled by the present invention which provides acid modified poly(vinyl acetate-vinyl propionate) textile sizes which, applied to the yarn as the salt of a monovalent cation, are suitable for use on conventional looms.

The textile sizes of the present invention have excellent solubility characteristics, film properties and adhesion to filament acetate, filament rayon and filament nylon and especially to filament and texturized polyester. Moreover, these sizes are easily removed from sized yarns or the resulting fabric using organic solvents, water or aqueous solutions of inorganic or organic monovalent bases.

It is, accordingly, one object of this invention to pro-

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vide novel interpolymer latices which are especially useful in the sizing of textile warp yarns.

It is a further object of this invention to provide improved compositions for sizing textile yarns, especially polyester warp yarns.

It is a further object of this invention to provide sized textile warp yarns which are covered with a tough, adherent, and flexible sizing agent which protects the yarns from mechanical damage during weaving and is left on the woven textile as a loom finish.

It is a further object of this invention to provide sized textile warp yarns which are covered with a tough adherent and flexible sizing agent which protects the yarns from mechanical damage during weaving and is readily removed from the yarns by a simple scouring in water.

It is a further object of this invention to provide sized textile warp yarns which are covered with a tough adherent and flexible sizing agent which protects the yarns from mechanical damage during weaving and is readily removed from the yarns by extraction with organic solvent.

### PREFERRED EMBODIMENTS

The sizes of the present invention are prepared from latices obtained by interpolymersing vinyl acetate, vinyl propionate and a variety of unsaturated organic carboxylic compounds containing from 3 to 9 carbon atoms and having at least one carboxyl group.

Examples of such carboxylic acids include the unsaturated organic monocarboxylic acids, as for example acrylic acid, methacrylic acid, crotonic acid and isocrotonic acid. Further examples of unsaturated carboxylic acids include partial esters of unsaturated polybasic carboxylic acids, for example, the half esters of maleic acid, fumaric acid, citraconic acid and itaconic acid in which the alkyl group contains from 1 to 4 carbon atoms, such as methyl, ethyl, propyl and butyl maleates. Mixtures of these acids may be used in the preparation of the interpolymer latices.

In the preparation of an interpolymer latex, the polymerization charge comprises from 50 to 92 percent by weight of vinyl acetate, from 5 to 40 percent by weight of vinyl propionate and from 3 to 10 percent by weight of ethylenically unsaturated carboxylic acid, based on the total weight of the monomers. More preferably, the polymerization charge comprises from 69 to 86 percent of vinyl acetate, from 10 to 25 percent of vinyl propionate and from 4 to 6 percent of ethylenically unsaturated carboxylic acid. The upper limit of acid is set by latex stability; the lower limit by polymer solubility in aqueous base.

The monomers are polymerized using latex polymerization methods at a temperature in the range of from 40 to 60° C. and preferably at a temperature in the range of from 40 to 45° C. At temperatures below about 40° C. the polymerization rate is too slow and the reaction mass tends to coagulate. At polymerization temperatures above 60° C. the product is of low molecular weight and lacks the tensile strength and elongation required in sizes.

The interpolymerization is carried out using a surfactant which comprises a phosphate ester of an alkyl phenol-ethylene oxide condensate wherein the alkyl group contains from 7 to 11 carbon atoms. Especially preferred are the phosphate esters of tertiary octyl phenol-ethylene oxide condensates (hereinafter referred to as PEOPEO) and the phosphate esters of nonyl phenoethylene oxide condensates (PENPEO). These preferred surfactants are available commercially as Triton XQS surfactants (Rohm & Haas Company) and GAFAC surfactants (General Aniline & Film Company), respectively. The amount of

the phosphate ester of an alkyl phenol-ethylene oxide condensate used will be in the range of from 1.0 to 4.0 percent by weight based on the total weight of the latex.

Preferably, the interpolymerization of the monomers is carried out using an anionic co-surfactant in combination with the phosphate esters of an alkyl phenol-ethylene oxide condensate. The use of the co-surfactants reduces the amount of coagulum in the resulting latex and provides a better product. The preferred co-surfactants used in the present invention include alkyl sulfonates such as sodium dodecyl benzene sulfonate; fatty alcohol sulfates such as sodium lauryl sulfate; dialkyl sulfosuccinates such as sodium dihexyl sulfosuccinate; etc. The amount of co-surfactant used is in the range of 0.1 to 0.4 percent by weight and more preferably 0.20 to 0.30 percent by weight based on the total weight of the latex.

The polymerization processes are initiated by a two component redox free radical initiator system. Suitable oxidizing components for the system are the inorganic peracid salts such as ammonium, potassium and sodium persulfates, perborates, and hydrogen peroxide. Preferred, however, are the oil soluble organic hydroperoxides such as t-butyl hydroperoxide, cumene hydroperoxide, p-menthane hydroperoxide, etc. and esters of the t-butyl perbenzoate type. The useful reducing components include compounds like the sulfites, bisulfites, hydrosulfites and thiosulfites; ethyl and other alkyl sulfites; the sulfoxylates, such as sodium formaldehyde sulfoxylate; and the like. Especially preferred are initiator systems based on t-butyl hydroperoxide and sodium formaldehyde sulfoxylate; and redox combinations such as mixtures of hydrogen peroxide and an iron salt, hydrogen peroxide and zinc formaldehyde sulfoxylate or other similar reducing agent; hydrogen peroxide and a titanous salt; potassium persulfate and sodium bisulfite and a bromate mixed with a bisulfite.

The use of equimolar amounts of initiator system components is generally preferred although the amount of each component as well as the total amount of catalyst used depends on the type of component used as well as on other polymerization conditions and may range between .02 and 0.2 percent by weight of the total polymerization system, the preferred range being 0.03 to 0.10 percent for the oxidizing component and 0.04 to 0.1 for the reducing component.

The solids contents of the latices can be varied over a wide range. The preferred latices having a solids content in the range of from 15 to 65 percent by weight and more preferably from 35 to 55 percent by weight, based on the total weight of the latex.

During the polymerization reaction a conventional base such as ammonium hydroxide or sodium hydroxide is used to buffer the latex to a pH in the range of 4.0 to 6.0.

The textile size solution may be prepared from the latex in several ways. In one method, an aqueous solution of base is mixed with the latex to dissolve the interpolymer by formation of the water soluble interpolymer carboxylate. Suitable bases include the hydroxides, carbonates and bicarbonates of alkali metals and alkaline earth metals such as sodium hydroxide, sodium carbonate and sodium bicarbonate; ammonia, organic bases such as methylamine, dimethylamine, trimethylamine, ethylamine, diethylamine, triethylamine, morpholine, etc. The preferred base in the preparation of a loom finish size is ammonium hydroxide since it contributes to good adhesion and resistance to water, water spotting and dry cleaning. The preferred base in the preparation of removable warp yarn size is sodium carbonate since it contributes to rapid solution of the interpolymer, good adhesion of the interpolymer size especially to polyester yarn and rapid removability of the size. A particular advantage of an interpolymer latex is that the fine size of the interpolymer particles allows rapid solubility of the interpolymer in aqueous base to form the size solution.

Another method for preparation of the textile size solution comprises the recovery of the interpolymer from the latex by conventional means and solution of the interpolymer in an organic solvent. The size is then applied to the textile yarn as an organic solution and may be removed from the woven goods with aqueous base or organic solvent.

Preferred organic solvents for preparation of size solutions and removal of size are alcohols, ketones, esters and aromatic solvents. Especially preferred are chlorinated aliphatic hydrocarbons such as methylene chloride, methylene bromide, chloroform, bromoform, ethylene dichloride, ethylene dibromide, ethylidene chloride, ethylidene bromide, s-tetrachloroethane, hexachloroethane, s-dichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethylene, trimethylene bromide, trichlorobromoethane, trichloromethane, 1,2,3-trichloropropane, 1,1,2-trichloropropane, trifluoro-1,1,2-tribromoethane, trifluoro-1,1,2-trichloroethane, 2,2-dichloro-1-bromoethane, 1,3-dichloro-2-methylpropane, 1,2-dichloro-2-methylpropane, 1,1-diiodoethane and the like. Chlorinated aliphatic liquid hydrocarbons are preferred in the practice of this invention because of their generally lower cost, greater availability, non-flammability, low toxicity and ease of recovery.

The following examples are set forth in illustration of the present invention and should not be construed as a limitation thereof. Unless otherwise indicated, all parts and percentages given are by weight.

#### PART A.—PREPARATION OF LATICES

##### Example 1

A latex is prepared in conventional latex polymerization equipment. The following charge is used:

Charge—	Parts
A:	
Water .....	62.03
Sodium hydroxide .....	0.18
PEOEO (70%) .....	2.25
Sodium dihexyl sulfosuccinate (80%) ..	0.25
Sodium formaldehyde sulfoxylate .....	0.0765
B:	
t-Butyl hydroperoxide (90%) .....	0.0465
Vinyl acetate .....	24.50
Vinyl propionate .....	8.75
Acrylic acid .....	1.75

Water and sodium hydroxide are charged to a glass lined reaction vessel. The solution is purged for 15 minutes to remove oxygen. The PEOEO surfactant, sodium dihexyl sulfosuccinate and sodium formaldehyde sulfoxylate are added. Tertiary-butyl hydroperoxide solution is dissolved in the monomer mixture and 8 percent of the monomer charge (Charge B) is dispersed in Charge A. The remaining 92 percent of Charge B is added at a constant rate over 2½ hours. The batch is mildly agitated and maintained at 42 to 44° C. during this time.

The resulting latex has a total solids of 35 percent, a pH of 5.0 and a Brookfield viscosity of 12 cps. The interpolymer has a specific viscosity of 2.44 in dimethyl sulfoxide at a concentration of 1 g. per 100 ml. Other properties of the latex are tabulated in Table I below.

##### Examples 2 to 5

The following Examples 2 to 5 are set forth to illustrate variations in the latex polymerization of the present invention. In each case the general procedures of Example 1 are followed except for the noted changes. Polymerization temperatures are maintained in the range from 41 to 45° C. The resulting latices have solids contents of 35 percent by weight and Brookfield viscosities in the range from 10 to 50 cps. at 25° C. The examples are tabulated in Table I.

TABLE I.—SUMMARY OF EXAMPLES 1 TO 5

Example.....	1	2	3	4	5
Charge A:					
Water.....	62.03	62.03	62.03	62.03	62.03
PEOPEO.....	2.25	2.25	2.25	2.25	2.25
Sodium dihexyl sulfosuccinate.....	0.25	0.25	0.25	0.25	0.25
NaOH.....	0.18	0.18	0.18	0.18	0.18
Charge B:					
Total monomer.....	35	35	35	35	35
Percent vinyl acetate.....	70	95	80	75	65
Percent vinyl propionate.....	25	0	15	20	30
Percent acrylic acid.....	5	5	5	5	5
Polymer properties:					
Specific viscosity, 1 g./100 ml.					
DMSO.....	2.44	2.70	1.67	2.46	1.30
Tensile strength, p.s.i., 65% RH.....	1,350	1,760	1,530	1,340	720
Elongation, percent, 65% RH.....	370	560	430	370	860
Polyester adhesion, lbs.....	57	27	37	48	40

In the foregoing Table I, specific viscosity measurements are determined on solutions of interpolymer in dimethyl sulfoxide (1 g. per 100 ml.)

Tensile strength and elongation are measured according to ASTM Method D-882-67 on interpolymer neutralized with sodium carbonate, after conditioning at 65 percent relative humidity.

Adhesion values are the loads in pounds required to break ½ x ¼ inch polyester lap joints adhered with 0.15 mil film of interpolymer. Experience has shown that an adhesion value of at least 30 pounds is required for satisfactory size performance with filament polyester on a commercial machine.

The vinyl propionate level is varied between 0 and 30 percent. Interpolation of the data in Table I indicates that adhesion values would be unsatisfactory with interpolymers containing less than 10 percent vinyl propionate. On the other hand, high concentrations of vinyl propionate in the interpolymer contribute to coagulation of the latex and to low molecular weight, low cohesive strength and tackiness of the polymeric size.

#### Examples 6 to 10

The following examples are set forth to illustrate the use of various acids in the preparation of the interpolymer latices. The latices are prepared by the procedure described in Example 1. Composition data for the interpolymers are presented in Table II. In every case a satisfactory latex and textile size is obtained.

TABLE II.—SUMMARY OF EXAMPLES 6 TO 10

Example.....	6	7	8	9	10
Total monomer.....	40	45	40	40	40
Percent vinyl acetate.....	72	68	70	70	70
Percent vinyl propionate.....	25	25	25	25	25
Acrylic acid.....	3	7			
Crotonic acid.....			5		
Monomethyl maleate.....				5	
Monomethyl fumarate.....					5

#### Examples 11 to 14

The following Examples 11 to 14 are set forth as control examples to illustrate the effect of polymerization temperature on the physical properties of the resulting latex. In each example the general procedure of Example 1 is repeated while the polymerization temperature is varied. The specific viscosity of the resulting polymer is then measured. The results are tabulated in Table III below.

TABLE III.—SUMMARY OF EXAMPLES 11 TO 14

Example	Polymerization temp., ° C.	Specific viscosity
11.....	40-45	2.58
12.....	35-39	( <sup>1</sup> )
13.....	46-50	2.12
14.....	51-55	2.03

<sup>1</sup> Run coagulated.

The data in the foregoing Table III indicate that, within the framework of the present invention polymerization temperatures below 40° C. lead to coagulation while in-

creasing temperatures above 45° C. lead to polymers with decreasing specific viscosities.

#### PART B.—TESTING OF THE LATICES AS TEXTILE SIZES

The latices prepared in Examples 1 to 5 are tested in order to determine their suitability as yarn sizes in conventional weaving processes. The sizes are prepared by dissolving the latex in a basic solution such as aqueous sodium carbonate, aqueous sodium hydroxide or aqueous ammonia.

The key properties considered in these tests are listed below.

**Solubility**—all of the latices in question are soluble in aqueous bases such as aqueous sodium carbonate to provide sizing solutions.

**Sizing solutions**—prepared from the latices of Examples 1 to 5 have Brookfield viscosities in the range of from 1 to 500 centipoises at 1 to 25 percent solids allowing ease of application to the yarn.

**Adhesion**—the latices of Examples 1 and 3 to have been tested and are found to have good adhesion to the following yarns—filaments, polyester, acetate rayon and nylon; texturized polyester; spun polyester, rayon, acetate and nylon.

**Solubility in mild alkali**—dried films of the latices in question are readily soluble in trisodium phosphate-surfactant solutions which indicate that the size is easily removed from the woven fabric.

**Solubility in organic solvent**—size solutions of interpolymer latex in aqueous ammonia are applied to yarn and dried. The dried films are readily soluble in chlorinated hydrocarbons.

**Size efficiency**—is a measure of the amount of size add-on required in a given operation. The add-on is the amount of size that must be applied to the yarn in order to permit it to be woven on a loom. In general, the less size add-on required, the more efficient the size. Sizes prepared from the latices of the present invention have high efficiency as is indicated by the following Examples 15 and 16.

**Polyester yarn**—filament polyester yarn is understood to mean rigid uncrimped yarn. Textured polyester yarn is understood to mean drawn and crimped yarn.

#### Example 15

**Filament polyester size.**—A 12 percent size solution is prepared by dissolving 2.9 pounds of sodium carbonate in 30 gallons of water, heating to 120° F. adding 110 pounds of a latex similar to Example 1 containing 36 weight percent of an interpolymer of vinyl acetate (70 parts), vinyl propionate (25 parts) and acrylic acid (5 parts). The solution is made up to 50 gallons with water. The resin dissolves rapidly at 130-140° F. The viscosity of the solution is 45 cps. at 25° C.

This sizing solution is applied at 130° F. to a 70 denier, 34 filament 5 turn per inch dull Type 57 Dacron filament polyester on a commercial seven can slasher, using a wet split section at 40 y.p.m., for a size add-on of 4.0 percent. Drying can temperatures are 300/220/220/220/220/190/200° F. The split is very easy.

The sized warp yarn is entered into a conventional Draper loom, weaving at 172 picks per minute. First quality fabric is woven at high efficiency. The fabric is desized in a conventional process by scouring in an aqueous solution of trisodium phosphate and wetting agent.

#### Example 16

**Texturized polyester size.**—A 6 percent size solution is prepared by dissolving 1.8 pounds of sodium carbonate in 30 gallons of water, heating to 120° F., adding 70 pounds of a latex similar to Example 1, containing 36 weight percent of an interpolymer of vinyl acetate (70 parts), vinyl propionate (25 parts) and acrylic acid (5 parts). The resin dissolves rapidly at 130° F. The solution is

brought to a final volume of 50 gallons. The viscosity of the solution is 7.5 cps. at 25° C.

This size solution is applied at 120° F. to a 150 denier 34 filament 1 turn texturized Dacron polyester on a commercial seven can slasher at 20 y.p.m. A wet split was employed, and the warp split easily, with no ends out. There was no can sticking, or skinning. A size add-on of 3.0 percent was obtained.

The sized warp yarn was woven on a conventional loom. A high weaving efficiency was obtained and the woven goods were of first quality. The fabric was desized in a conventional process by scouring in a bath containing an aqueous solution of tri-sodium phosphate and non-ionic wetting agent.

Sizes which are obtained from polymers prepared by the process of the present invention are compared to commercially available textile sizes. The sizes in the form of the sodium salt are cast as films, dried and tested at 65 percent relative humidity for tensile strength, elongation and toughness. The toughness value is the product of tensile strength and elongation. Polyester lap joints, 1/2 x 1/4 inch containing 0.15 mil thickness of interpolmer are tested for adhesion. The results of the comparison are set forth below.

TABLE IV.—COMPARISON OF SIZE PROPERTIES

Size	Composition (wt. percent)	Spec. viso., 1 g./100 ml.	Tensile strength, p.s.i.	Elongation, percent	Toughness, ×10 <sup>4</sup>	Adhesion, pounds
A	VA/VP/AA (80/15/5)	1.67	1,530	430	66	37
B	VA/VP/AA (70/25/5)	2.44	1,350	370	50	57
C	VA/DBM/AA (91.65/5/3.55)	1.79	1,580	300	47	12
D	VA/CA (96/4)	0.7	2,000	200	40	20-25
E	VA/MMM (93/7)	1.4	2,250	160	36	14
F	VA/MIBM (79/21)	1.9	1,400	400	56	16
G	VA/MA (47/53)		500	500	25	10-15
H	Gelatin size		5,300	50	26	v. poor
I	S/MA (50/50)		1,800	30	35	0.5
J	PVOH, partially hydrolyzed					<20

NOTE.—VA=vinyl acetate; VP=vinyl propionate; DBM=dimethyl maleate; MMM=monomethyl maleate; MIBM=monoisobutyl maleate; AA=acrylic acid; CA=crotonic acid; MA=maleic anhydride; PVOH=polyvinyl alcohol.

Sizes A and B are obtained from latices prepared in the manner described in Examples 3 and 1 respectively. Sizes C to J are commercially available sizes representative of the prior art. Note the superior adhesion and toughness of sizes A and B. As pointed out above, experience has shown that values of adhesion less than 30 pounds can be equated with inadequate performance on a commercial slasher. Sizes A and B have values comfortably above this while the commercial sizes C to J fall far short of it.

#### Example 17

A latex composition is prepared as in Example 1. The resulting latex is dissolved in aqueous ammonia to give a 5.0 percent solution of interpolmer having a pH of 9.0. The sizing solution is applied to 150 denier, 41 monofilament, low twist bright acetate yarn. The sized warp yarn is woven on a conventional loom. The size adheres well to the woven fabric and shows excellent resistance to water, water spotting and dry cleaning.

#### Example 18

A latex composition is prepared as in Example 1 and coagulated by addition of acetone. The interpolmer is recovered and dried. It is then dissolved in trichloroethylene to give a 5.0 percent solution. The solution is used to size filament nylon yarn.

#### Example 19

A latex composition is prepared as in Example 1. The resulting latex is dissolved in aqueous ammonia to give a 5.0 percent solution of interpolmer having a pH of 9.0. The solution is used to size filament polyester yarn.

The sized warp yarn is woven on a conventional loom. Size is removed from the woven goods by extraction with 1,1,1-trichloroethylene.

The sizes of the present invention may be formulated with lubricants, defoamers, humectants, plasticizers, softening agents and other adjuncts without departing from the scope of the invention.

From the foregoing, it should be obvious that many variations are possible in the present invention without departing from the spirit and scope thereof.

What is claimed is:

1. A textile size which comprises an aqueous base solution of an interpolmerization product consisting essentially of from 50 to 92 percent by weight of vinyl acetate, from 5 to 40 percent by weight of vinyl propionate and from 3 to 10 percent by weight of an ethylenically unsaturated carboxylic acid selected from the group consisting of acrylic acid, methacrylic acid, crotonic acid, isocrotonic acid and monoalkyl esters of maleic acid, fumaric acid, citraconic acid and itaconic acid in which the alkyl group contains from 1-4 carbon atoms, wherein the percent by weight is based on the total weight of the monomers.

2. A textile size as in claim 1 wherein the amount of vinyl acetate is in the range from 68 to 86 percent, the

amount of vinyl propionate is in the range from 10 to 25 percent and the amount of ethylenically unsaturated carboxylic acid containing from 3 to 9 carbon atoms is in the range from 4 to 7 percent by weight.

3. A textile size as in claim 1 wherein the ethylenically unsaturated carboxylic acid is selected from the group consisting of acrylic acid, crotonic acid, isocrotonic acid, monomethyl maleate and monomethyl fumarate.

4. A textile size as in claim 1 wherein the interpolmer has a specific viscosity in the range from 1.2 to 12 at 25° C. in dimethyl sulfoxide at a concentration of 1 gram per 100 ml.

5. A textile size as in claim 1 wherein the size contains from 1 to 25 percent by weight of interpolmer based on the total weight of the size solution.

6. A textile size as in claim 1 wherein the aqueous base is an aqueous solution of a base selected from the group consisting of the hydroxides, carbonates and bicarbonates of alkali metals and alkaline earth metals; ammonia; methylamine dimethylamine, trimethylamine, ethylamine, diethylamine, triethylamine and morpholine.

7. A textile size as in claim 1 wherein the aqueous base is an aqueous solution of ammonia.

8. A textile size which comprises an aqueous base solution of a latex interpolmerization product consisting essentially of from 50 to 92 percent by weight of vinyl acetate, from 5 to 40 percent by weight of vinyl propionate and from 3 to 10 percent by weight of an ethylenically unsaturated carboxylic acid selected from the group consisting of acrylic acid, crotonic acid, isocrotonic acid, monomethyl maleate and monomethyl fumarate, wherein the percent by weight is based on the total weight of the monomers; wherein the interpolmer in dimethyl sulfox-

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ide at a concentration of 1 gram per 100 ml. has a specific viscosity in the range of from 1.3 to 10 at 25° C.; and wherein the size contains from 1 to 25 percent by weight of interpolmer based on the total weight of the aqueous solution.

9. A textile size as in claim 1 wherein the aqueous base is sodium carbonate.

10. A textile size as in claim 8 wherein the aqueous base is an aqueous solution of a base selected from the group consisting of the hydroxides, carbonates and bi-carbonates of alkali metals and alkaline earth metals; ammonia; methylamine dimethylamine, trimethylamine, ethylamine, diethylamine, triethylamine and morpholine.

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References Cited

UNITED STATES PATENTS

2,855,387	10/1958	Barrett	260—78.5
3,003,987	10/1961	Hager et al.	260—29.6 T A
3,455,887	7/1969	Levine	260—78.5

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