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SYNTHETIC FIBER PAPERS

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This invention relates to new paper products, and more specifically to new papers from synthetic organic fibers, and to a process for making such papers.

In conventional paper making processes, shredded cellulose fibers, such as wood pulp, are beaten up in a water suspension until the cellulose fiber becomes swollen with the water. The suspension is then poured onto a draining screen and the excess water is removed. Because of the swollen nature of the fibers, they adhere to one another with the result that the water leaf is strong enough to be handled in both the wet and the dry state without damage. This strength makes it possible to process the paper in subsequent operations without tearing the leaf or otherwise damaging it.

Papers made from fibers of synthetic organic polymers have been difficult to prepare because synthetic fibers do not respond to the beating treatment as cellulosic fibers do. Because of their insensitivity to water, synthetic organic fibers are not swollen during the beating process and when they are laid down in a water leaf, this leaf lacks sufficient strength in both the wet and the dry state to permit ready handling. For example, handsheets prepared in a conventional manner from cellulose wood pulp have tensile strengths after drying ranging from 1.5 to 10.0 pounds per inch per ounce per square yard. Herein-after tensile strengths will be stated, for convenience, simply as a number, but it will be understood that the number will refer to pounds per inch per ounce per square yard. Quarter-inch staple fibers prepared from 100% polyacrylonitrile when formed into a handsheet in a similar manner have a dry tensile strength of 0.005 which is so low that operations on a commercial paper machine are impossible.

It would be desirable to prepare a paper from synthetic organic fibers which would have sufficient strength both as a wet water leaf and as a dry water leaf, to permit its being processed on normal paper-making machinery without undue care in handling. This might be done by adding resins, for example, melamine-formaldehyde or urea-formaldehyde resins, to the fiber slurry, and then curing the resin-impregnated leaf after drying. Such an operation is, however, unsatisfactory because no resin has been found that is specific to the fibers and, consequently, the resin is not preferentially retained in the water leaf. If a resin is added to the leaf by a saturation process in the paper machine, not only does special and costly equipment have to be used, but it is impossible to reuse scrap pieces and waste stock by reslurrying the fibers.

It would be desirable if a method could be found to augment the strength of a synthetic fiber water leaf while retaining freedom for further processing. Ideally, such a method should require no extra processing equipment, permit reuse of scrap material, be compatible with later finishing treatment such as resin impregnation, and increase the strength of the water leaf to a level comparable with wood-pulp-based water leaves. A tensile strength of at least 1.5 lb./in./oz./yd.² is ample to permit ready handling of the leaf on standard paper-making machinery.

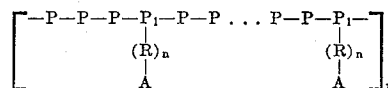
It would also be desirable to have available a material from which synthetic organic fiber papers could be prepared without the necessity of adding resins, binders, or other materials to the stock chest during the preparation

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of the furnish. If such a material could be maintained on hand and used directly as needed in making a synthetic organic polymer based paper or handsheet, flexibility of paper-making operations would be greatly improved. Of course, if such flexibility is to have any real advantage, elaborate treatment of the water leaf must not be necessary to permit ready processing; that is, such a supply of synthetic organic polymer fibers must simulate the wood pulp which is currently used in paper processing, so that an operator need merely add to the stock chest the prepared composition containing the synthetic organic polymer fibers and proceed with the slurring in the normal manner. Such a composite material would have the further advantage that it could be utilized in other processes for the formation of non-woven webs and sheets, in addition to its utility in conventional paper-making equipment.

It is an object of this invention to provide a blended composition of synthetic organic fibers and temporary binders, to provide paper with increased wet and dry strength suitable for further processing on conventional paper-making machinery. It is a further object of this invention to provide new paper water leaves from synthetic organic fibers, which water leaves have greatly increased tensile strength permitting ready handling of the leaf in conventional paper-making processes. It is a still further object of this invention to provide a new process for making a water leaf with increased wet and dry strength from fibers of synthetic organic polymers. Other objects will be apparent from the description below.

In accordance with this invention there is provided a composition comprising a mixture of a water-swellaable, water-insoluble gum and staple fibers of a water-insoluble, synthetic organic polymer containing along the polymer chain a plurality of available hydrophilic groups. The term "available" as applied to hydrophilic groups means that the groups are capable of reaction with other suitable reactants, as, for example, an "available" sulfonic acid group will react with an alcohol to form an ester under known esterifying conditions. The term "hydrophilic group" refers to radicals attached to structural portions of the polymer chain, preferably in the course of a copolymerization reaction, whereby there is produced a polymer having the structural formula of the type:



where —P— denotes a homopolymerizable group,



is a group copolymerizable with —P— and not necessarily different from —P—, —R— denotes a permissible side-chain group, —A denotes a hydrophilic monovalent radical, *n* is zero or one, and *x* is a number sufficiently large so that the polymer is fiber-forming.

The above structural formula is not intended to specify the actual distribution of modifier groups in the polymer chain but to indicate that the modifier groups appear at more or less random intervals along the chain. It is necessary that the modifier group



be capable of forming a homopolymer which is soluble in water to the extent of at least 10% by weight, and must be present in the polymer of this invention to the extent of at least 0.001 mole of modifier group per 100 grams of polymer, and present in addition to normally occurring terminal groups at the end of primary polymer

chains. Preferred hydrophilic groups are oxy-acid groups such as carboxy and sulfonic, salts of these oxy-acid groups and amides of these oxy-acids.

A gum is present in the blend of this invention in a concentration of at least 3% (by weight) of the total solids of the mixture. To be effective, the gum must have a gel volume of greater than 15 cc. per gram, a cooked viscosity of at least 200 cps. at 25° C., and must form, in water at room temperature, discrete swollen particles having a radius of between 10 and 100 microns. The compositions of this invention are useful both as a dry blend and as a slurry in aqueous solutions.

A gum which forms discrete particles 10 to 200 microns in diameter when dispersed in cold water is a "water insoluble" gum of this invention.

The term "gel volume," as used herein, is a measure of the swellability of a gum in cold water. It is determined as follows: The gum is ground or powdered and passed through standard screens to isolate that portion which passes through a 100-mesh screen and is retained on a 300-mesh screen. One-tenth of a gram (0.1 g.) of this gum is vigorously agitated with 100 ml. of water at 25° C. in a Waring Blendor for 20 minutes. The contents of the Blendor jar are transferred to a 100 ml. graduated cylinder, and allowed to settle for 24 hours. At the end of this time the settled volume is observed. The gel volume is calculated by dividing the settled volume by the sample weight.

The cooked viscosity of a gum, a measure of hot-swellability, is measured by heating a 1% aqueous dispersion of the gum (100-300 mesh) at 90° C. for 1 hour. The solution is then cooled to 28° C., and the viscosity of the liquid is measured using any standard viscometer, such as the rotating cylinder type.

Particle size of a water-swollen gum is readily determined using light-scattering techniques, as disclosed in "Principles of Polymer Chemistry" by P. J. Flory, Cornell University Press, Ithaca (1953), pp. 283-303.

The products of this invention can be prepared by slurrying in water a blend comprising the gum and the synthetic fiber as already described, and using the slurry as desired, for example, in the formation of a water leaf by known procedures. It is also within the scope of this invention to add separately to an appropriate volume of water the required quantities of gum and fiber as already described, and proceed with the preparation of a slurry which can be used as desired, for example, to form a water leaf.

further handling. However, one of the gums of the present invention can then be sifted or blown onto the web to give a blended structure, in which the gum is distributed throughout the web. In the dry state, the gum can readily be applied in this manner. Then the composite web, still on the belt, can be activated by suitable means, such as, for example, the application of a jet of live steam, which will cause the gum to bond to the fibers in the same relative disposition which existed prior to the activating step. Immediately after this activation, the web is found to possess adequate strength so that it can be removed from the belt in a routine manner, and processed further. Such an operation avoids the slurring step, while still giving a bonded non-woven sheet.

By the practice of this invention, there can be obtained a water leaf of synthetic organic fibers bonded by swollen gum particles to the extent that the sheet possesses adequate wet- and dry-strength to permit further processing by routine techniques. Such water leaves are also capable of being reslurried and reprocessed where desirable. Gums of the type described contain chemical groups of a nature suited to form secondary bonds with the ionic modifier groups of the modified fiber-forming polymers. Because of their particulate nature, the gums of this invention are retained in the fiber web as it is formed, and are, therefore, most effective in increasing the strength of the water leaf.

Water-soluble gums, such as carboxymethyl cellulose, are not retained well in the water leaf. Gums which are not water-swollen do not form secondary bonds with the fibers to provide increased strength. Because the bonds formed are of a type which can be broken by water and agitation, any waste paper stock can be reslurried easily. Furthermore, the presence of the preferred gums in no way interferes with calendering, sizing, or resin-bonding processes which may follow the formation of the water leaf.

A wide variety of natural and synthetic gums have been conventionally used as sizes on papers and fabrics. Some of these gums are suitable for use in the present invention. Table I gives data on various gums well known in the art for use in such applications. The data of Table I are illustrative only and are not intended to indicate the full range of gums which are useful in the present invention. Rather, the definition of suitable characteristics of gums as already presented is the criterion of whether or not a gum is suitable in the present application.

TABLE I

	Gums									
	Iocust Bean	Karaya	Tragacanth	Guar	Carboxymethyl Cellulose	Sodium Polyacrylate	Arabic	Sodium Alginate	Daktose	Irish Moss
Dry Particle Size ¹	100-300 mesh.	100-300 mesh.	100-300 mesh.	100-300 mesh.	100-300 mesh.	100-300 mesh.	100-300 mesh.	100-300 mesh.	100-300 mesh.	100-300 mesh.
Water Dispersible.....	yes.....	yes.....	yes.....	yes.....	yes.....	yes.....	yes.....	yes.....	yes.....	yes.....
Forms Discrete Particles in Cold Water.....	yes.....	yes.....	yes.....	yes.....	no.....	no.....	no.....	no.....	no.....	no.....
Swollen Particle Size (in cold water).....	10-200.....	10-200.....	10-200.....	10-200.....	dissolves.....	dissolves.....	dissolves.....	dissolves.....	dissolves.....	dissolves.....
Gel Volume (cc./gm.).....	20.....	100.....	190.....	60.....					15.....	20.....
Cooked Viscosity in cps. at 25° C. for 1% solution.....	4,000.....	1,500.....	200.....	4,000.....	1,500.....	300.....	100.....	2,000.....	10.....	500.....
Useful as Bonding Agent.....	yes.....	yes.....	yes.....	yes.....	no.....	no.....	no.....	no.....	no.....	no.....

¹ Standard screens.

A blend of gum and fibers from suitable polymers may also be formed into a useful and desirable shape and the gum activated in such a way that the shaped article is sufficiently strong to be readily handled for further processing. One such method of operation is to feed a carded web of synthetic organic fibers, containing modifiers as already described, onto a porous conveyor belt or similar structures. Such a web lacks strength for

The increased strength of the products of this invention, as well as the practice of the process involved, can best be illustrated in specific formulations. The examples compare suitable and unsuitable gums, modified and unmodified fibers, and illustrate the quantities of materials needed for the practice of the present invention. All strength data refer to dry tensile strengths in pounds per inch per ounce per square yard unless otherwise indi-

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cated. In order to simplify the description of these examples, a general procedure was adopted for preparing handsheets of paper from various combinations of fibers with and without gums as follows, and this procedure followed in all examples. This procedure is given below:

(1) A water dispersion of the gum to be used is prepared by adding the required quantity of the gum, in a particle size which will pass through a 100-mesh screen but will be retained by 300 mesh-screen, to a tank containing 9-liters of water. The gum is slowly sifted into the water which is vigorously agitated. After all the gum is added, agitation is continued for 20 minutes. If no gum is to be used, the 9 liter volume of water is measured out into the tank.

(2) The gum slurry (or plain water if no gum is to be used) is transferred to a slurry tank of a handsheet mold which is 8" x 8" and is fitted with a 100-mesh screen. The outlet to the tank is kept closed.

(3) A 4-gram sample of the fiber to be used (in the form of 1/4" long staple) is slurried gently in a Waring Blendor with 1 liter of water. Agitation is continued for 2 minutes, following which the fiber slurry is added to the gum slurry into the handsheet mold.

(4) The fiber-gum slurry is agitated in the handsheet mold about 6-10 times with general vertical action by means of a perforated metal sheet.

(5) The outlet to the slurry tank is now connected with a vacuum line and the water is drained off rapidly through the 100-mesh screen, thereby depositing on the screen a wet water leaf of the fibers.

(6) The screen supporting the water leaf is removed from the mold and a sheet of glass fabric which has been coated with "Teflon" tetrafluoroethylene resin is gently laid on top of the water leaf. The sandwich of the water leaf between the screen and the glass fabric is then gently squeezed between the rolls of a hand wringer to remove excess water.

(7) The screen is removed and the handsheet which remains on the glass fabric is now placed in an oven at 100° C. until dry.

(8) The dry handsheet is tested for tensile strength using a standard Amthor tensile tester.

This procedure was used in the following examples. All gum concentrations are based upon total solids.

Example I

A copolymer of 98% acrylonitrile and 2% sodium styrene sulfonate is spun into fibers of 1 to 3 d.p.f. by conventional spinning procedures. The fibers are drawn and processed in the normal manner and then chopped into 1/4" lengths. These fibers are formed into a handsheet retaining 15% karaya gum in the sheet. The dry strength of the leaf so prepared is 2.1. When the karaya gum is omitted from the procedure, the handsheet has a strength of 0.005. When the same amount of locust bean gum is used in place of karaya gum, the strength of the dry handsheet is 6.

Example II

The procedure of Example I is followed except that the fiber is prepared from 100% polyacrylonitrile without modification to introduce hydrophilic groups. The handsheet is first prepared with karaya gum giving a dry strength of 0.8. When the gum is omitted entirely, the strength is 0.005. Both of these strengths are lower than the 1.5 value necessary for useful operation on a commercial paper-making machine.

Example III

The procedure of Example I is followed using the same copolymer except that different gums are employed. Three different gums in the amount of 15% as described in Table I are used in separate experiments: carboxymethyl cellulose, sodium alginate, and gum arabic. In each case, the tensile strength of the dry sheet is 0.05.

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While this value represents a 10-fold increase over the sheet made without any gum, this strength is still considerably lower than what is necessary for successful operation on a commercial paper-making machine.

Example IV

This experiment is illustrative of the practice of the present invention in the particular aspect of employing a pre-mixed blend of fiber and gums.

A quantity of fibers similar to those described in Example I is dry-mixed with locust bean gum in the proportions of 5 parts of fiber to 1 part of gum. The gum is prepared by grinding and screening to pass through a 100-mesh screen, and be retained on a 300-mesh screen. The mixture is shaken by hand for 1 minute and then added to the stock chest of a paper-making machine, in the ratio of 5.3 parts of blend to 10,000 parts of water. The furnish is stirred 15 minutes, and the water drained off. The water leaf formed in this manner retains 10% gum by weight and has a dry strength of 1.7.

Example V

Commercial polyhexamethylene adipamide fibers of 1-3 denier are chopped into 1/4" lengths and a handsheet is prepared without gum. The strength is 0.005. When locust bean gum is used in the amount of 5%, the strength of the handsheet is 0.4.

Example VI

Polyhexamethylene adipamide fibers (3 denier) are modified by copolymerization to contain 10% sodium polyacrylate. These fibers are used to prepare a handsheet. When made without gum, the dry strength of this sheet is 0.005. When locust bean gum in the amount of 5% is used, the dry strength is 2.1. When similar amounts of sodium carboxy methyl cellulose or sodium alginate are used as gums, the dry strength is 0.05. Only the gums of this invention give sheets of sufficient strength for processing on commercial paper-making machinery. Similar results are obtained when the potassium and lithium salts of polyacrylic acid are used instead of the sodium salt. When calcium and aluminum salts are used, the dry strength of the leaves (with gum) is 1.5.

Example VII

A copolymer is prepared by copolymerizing 96% ethylene terephthalate and 4% ethylene isophthalate sodium sulfonate, which contains one sodium sulfonate group in the 5-position on the isophthalate ring. This copolymer is melt-spun into fibers by a conventional process and cut into staple fibers of 3 denier/filament and 1/4 inch in length. When the staple fiber is made into a handsheet using locust bean gum, in the amount of 5%, the strength of the dry product is 1.5. When karaya gum in the amount of 10% is used, the strength is 1.4. When carboxymethyl cellulose in the amount of 10% is used, the strength is 0.05. When no gum is used, the sheet has a dry strength of 0.005.

Additional examples of the practice of this invention are given in Table II which shows various polymer modifications formed into fibers and made into handsheets using several gums. Different levels of polymer modification are shown. It will be seen from this table that a very modest level of modification is sufficient to produce high strength synthetic fiber papers when gums of this invention are used. With other gums, it is not possible to obtain such high strengths even at high gum concentrations. Table II also shows strengths of the papers with different amounts of gum. A 5-10% gum concentration is generally useful in producing high strength and while additional quantities of gum provide some further improvement this improvement is not necessary for ready processing. In fact, very high gum concentrations may cause some deterioration of other desirable characteristics of the water leaf.

TABLE II

Example	FIBER COMPOSITION			GUM		Dry Leaf Strength lb./in./oz./ yd. ²
	Base Polymer	Modifier	Percent Modifier	Type Gum	Percent Gum (on total solids)	
VIII.....	Polyacrylonitrile.....	none.....		locust bean.....	5.....	0.7
IX.....	do.....	do.....		karaya.....	5.....	0.37
X.....	do.....	Methyl acrylate.....	5.....	do.....	5.....	1.7
		Na styrene sulfonate.....	0.5.....			
XI.....	do.....	Methyl acrylate.....	5.....	locust bean.....	5.....	2.2
		Na styrene sulfonate.....	0.5.....			
XII.....	do.....	Na styrene sulfonate.....	2.....	do.....	13.....	4.7
XIII.....	do.....	do.....	0.2.....	do.....	20.....	6.0
XIV.....	do.....	do.....	0.2.....	do.....	30.....	10.0
XV.....	Polyhexamethylene adipamide.....	none.....		guar.....	5.....	0.25
XVI.....	do.....	Na styrene sulfonate.....	3.....	locust bean.....	5.....	2.0
XVII.....	do.....	Na Polyacrylate.....	10.....	karaya.....	20.....	1.5
XVIII.....	do.....	Na acrylate.....	10.....	locust bean.....	13.....	3.4
XIX.....	do.....	do.....	10.....	do.....	20.....	6.5
XX.....	do.....	do.....	10.....	do.....	30.....	6.9
XXI.....	do.....	Acrylamide.....	5.....	do.....	20.....	3.8
XXII.....	do.....	Acrylic acid.....	5.....	do.....	20.....	3.1

It is obvious from the above examples that the necessary hydrophilic groups may be introduced into the polymer by any suitable copolymerization reaction. However, there are other satisfactory methods as well. Modification of the polymer in fiber form is one such method. For example, fibers identical with those of Example II are treated with a 2% solution of sodium hydroxide at 100° C., whereby a small percentage of the cyanide ($-\text{C}\equiv\text{N}$) side groups are converted into $-\text{COONa}$ groups. The resulting fibers are washed and used to prepare a handsheet following the procedure of Example I. The sheet has a strength of 2.1 when locust bean gum is used.

Example XXIII

Procedure of Example VI is repeated, except that both karaya and locust bean are used; 4% of the former and 10% of the latter is retained in the paper. The dry strength of the paper is 6.

Example XXIV

The fiber of Example VI is made into a 500-gallon aqueous slurry with 0.1% fiber content and processed on a conventional Fourdrinier paper machine. It is not possible to transfer the extremely weak web from the wire to the press felt. When locust bean gum is added to the slurry (sufficient amount to retain 15% in the dry sheet), the water leaf has sufficient strength to pass from the wire to the press felt, to span subsequently a 5-foot gap between the press felt and the drier felt, and to be wound up as dry paper. The incorporation of an identical amount of locust bean gum in a similar aqueous slurry of unmodified polyhexamethylene adipamide fibers does not permit the development of sufficient strength and the water leaf cannot be transferred from the wire to the press felt.

As the examples show, only a small amount of the proper gum is needed to give the water leaf adequate strength. At this stage of the paper-making process, tensile strength of the sheet is the major requirement, and 5% to 10% gum, based on total solids content, is sufficient to give a tensile strength of 1.5. As the gum content is increased, the tensile strength of the leaf is also increased but such a further increase is not necessary. Besides, as the gum concentration is increased beyond 15%, other physical properties useful in the final product are decreased. For example, the tear strength of a sheet prepared as in Example VI with 15% locust bean is 260 grams. However, if the gum concentration is increased to 35%, the tear strength decreases to 150 grams. Furthermore, above the 15% level, excessive amounts of gum cause undue water sensitivity and stiffness as well as poor re-impregnatability of the paper product. Therefore, the preferred range of gum concentration is from 3 to 15%.

From the foregoing description, it is apparent that the practice of this invention is operable over a range of compositions of fibers, modifiers and bonding gums. Furthermore, the relative amounts of each of these ingredients can be varied while retaining the advantages already set forth.

In addition to the base polymers shown, other fiber-forming, water-insoluble polymers may be used, such as polyvinyl chloride, polyvinylidene chloride, copolymers of vinyl chloride with other vinyl derivatives, acrylic polymers and copolymers, polyamides, polyurethanes, polyesters, and the like, and mixtures and copolymers of these and others. For natural and synthetic fibers which are water-swollen to a degree comparable to cellulose, the improvements in strength afforded by this invention will normally be found to be unnecessary. However, even in such cases, polymer modification and gum-bonding may have advantages.

Oxy-acid groups are preferred hydrophilic groups, because they form bonds most readily with the gums which are available, but other combinations of acidic modifying groups and coreactive gum are useful. In all cases, the reactive modifier group need not be attached directly to the polymer backbone (main polymer chain), but may be part of a side-chain, and any one side-chain may contain more than one reactive modifier group. In general, the presence of terminal acidic groups at the ends of primary polymer chains has not been found to lead to adequate bonding; the effectiveness of the modifier groups appears to depend on the presence of a plurality of bonding-sites at intervals along the chain.

While several specific gums have been shown to be most desirable, other gums can also be used. As already stated, and shown in Table I, water-swollen but water-insoluble gums are needed to increase the strength of the papers of this invention to the desired level. There may be certain advantages in using a mixture of gums. One gum, such as karaya, may contribute more strength during the initial (cold) drying, while another, such as locust bean, may contribute most strength during the later (hot) stages of drying.

This invention overcomes a major obstacle in the preparation of papers wholly from synthetic fibers. The demand for such papers is not in the low-strength, high-volume uses, such as newsprint. Rather, synthetic fiber papers find their greatest application in fields where great strength, great abrasion resistance dimensional stability and other physical properties are needed. Shipping bags, heavy-duty and long-use sheetings, backings for coatings and the like, take full advantage of the great strength of synthetic fibers. In these uses, the ultimate product may well be resin-bonded as a final stage of processing, and resin-bonding can permit full utilization of the fiber properties. But resin-bonding in the early stages of process-

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ing is highly undesirable. Therefore, the present invention, which makes it possible to handle high-strength, water-insensitive fibers by conventional processes, makes a valuable contribution to the art of making papers from synthetic fibers.

The claimed invention:

1. A composition comprising staple fibers of a hydrophilic, water-insoluble, synthetic organic polymer and 3% to 15% by weight of a water-swellaable, water-insoluble gum in admixture therewith, said synthetic organic polymer containing copolymerizable groups —P—, and



in which —P— may be the same as



—R— is any suitable side-chain group substantially inert during polymerization of said copolymerizable groups, —A is a hydrophilic group, n is a number less than 2, the group



being present in the polymer to the extent of at least 0.001 mole per 100 grams of polymer, and said gum having a gel volume of greater than 15 cc. per gram and a cooked viscosity of at least 200 centipoises as a 1% aqueous dispersion at 25° C., and forming in water at room temperature discrete swollen particles having a radius of between 10 and 100 microns..

2. The composition of claim 1 in which the hydrophilic group (—A) is an ionic group.

3. The composition of claim 1 in which the gum is selected from the group consisting of locust bean gum, karaya gum, guar gum, and tragacanth gum, and the hydrophilic group is selected from the group consisting of carboxylic and sulfonic groups, salts of carboxylic and sulfonic groups and amides thereof.

4. The composition of claim 1 in which the polymer is an acrylonitrile polymer containing at least 85% combined acrylonitrile.

5. The composition of claim 4 in which the gum is selected from the group consisting of locust bean gum, karaya gum, guar gum, and tragacanth gum, and the hydrophilic group is selected from the group consisting of carboxylic and sulfonic groups, salts of carboxylic and sulfonic groups and amides thereof.

6. The composition of claim 4 in which the acrylonitrile polymer is a copolymer of acrylonitrile and sodium styrene sulfonate.

7. The composition of claim 1 in which the polymer is a nylon polymer.

8. The composition of claim 7 in which the nylon polymer is a copolymer of polyhexamethylene adipamide and sodium polyacrylate.

9. The composition of claim 1 in which the polymer is a copolymer of ethylene terephthalate and sodium isophthalate sodium sulfonate.

10. An aqueous slurry of the composition of claim 1.

11. A process for preparing a fibrous web which comprises slurring in water a mixture containing a water-

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swellaable, water-insoluble gum and a water-insoluble fiber of a synthetic organic polymer containing copolymerizable groups —P—, and



in which —P— may be the same as



—R— is any suitable side-chain group substantially inert during polymerization of said copolymerizable groups, —A is a hydrophilic group, n is a number less than 2, the group



being present in the polymer to the extent of at least 0.001 mole per 100 grams of polymer, forming the resulting slurry into a predetermined shape and removing the water therefrom to form a web.

12. A process for preparing a fibrous web which comprises slurring in water a water-swellaable, water-insoluble gum, admixing therewith an aqueous slurry of water-insoluble fiber of a synthetic organic polymer containing copolymerizable groups —P—, and



in which —P— may be the same as



—R— is any suitable side-chain group substantially inert during polymerization of said copolymerizable groups, —A is a hydrophilic group, n is a number less than 2, the group



being present in the polymer to the extent of at least 0.001 mole per 100 grams of polymer, forming the resulting slurry into a predetermined shape and removing water therefrom to form a web.

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