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3,480,016

SANITARY PRODUCTS

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18 Claims

ABSTRACT OF THE DISCLOSURE

Toilet-flushable sanitary products capable of absorbing body discharge such as diapers and sanitary napkins are disclosed which have excellent dry and wet strength and which comprise a scrim or paper of biodegradable fibers such as cellulosic fibers bound together by a resin possessing certain critical characteristics including the fact that it is stable to body discharge but capable of being degraded in a toilet system upon the addition of a suitable substance and padding of unbonded water-dispersible absorbent material.

This application is a continuation in part of pending application Ser. No. 702,511 filed Feb. 2, 1968.

A potentially huge market exists for a truly disposable diaper which will enable the consumer to avoid the expense and unpleasantness associated with cleaning conventional cloth diapers. Several types of non-woven diapers designed to be thrown away after a single use have been developed. These diapers however still present the problem of how and where to dispose of them both in and out of the household. Treating the soiled diapers as ordinary garbage involves obvious unpleasantness associated with their handling and storage.

Several workers in the art have proposed diapers which purportedly can be disposed of in a family septic tank or toilet. While this approach would solve the problem, it presupposes that the diaper structure readily disintegrates or disperses in the toilet in order to avoid plugging of the plumbing system. Dispersibility in water has generally been predicated upon structural disintegration through the weakening of inter-fiber friction.

These previously suggested dispersible diapers have been seriously lacking in one or more respects. For example, some require tearing or shredding before disposal and thus significantly involve unpleasant handling. Other proposed diaper structures do not break up easily and quickly in the toilet. Still others require the removal of a non-disintegratable plastic film backing and others simply do not hold up under use.

It is an object of this invention to provide diapers and other sanitary products which are inexpensive enough to dispose of after a single use. It is a further object that these products possess sufficient wet strength to maintain their structural integrity under the conditions of use without the need for textile fabric reinforcement. The products should, of course, have sufficient dry strength so that handling, folding and packaging will not tear or puncture them. It is a still further object to provide a process so that these products be readily, easily and safely disposed of in a toilet bowl or septic tank without the need for tearing. As a still further object, the products should be aesthetically pleasing in hand and appearance, i.e., whiteness, and non-irritating to the human skin.

It has now been found that sanitary products can be prepared which meet all of the above objects by providing a non-woven structure comprising a water dispersible absorbent inner layer covered at least on one side with a paper or scrim which comprises biodegradable, e.g. cellu-

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losic, fibers bound together with a resin which is non-irritating to the human body and characterized by being stable in body discharge but capable of being degraded in a toilet system upon the addition of a suitable degrading agent.

The term degraded is used in its generic sense and is not necessarily limited to chemical degradation, i.e., the reduction of the number of carbon atoms in a chain. Thus, it refers to the swollen, solubilized, partially solubilized, oxidized or reduced state of the resin binder subsequent to interaction with a suitable degrading agent.

In addition to diapers, other sanitary products within the scope of this invention are catamenial devices such as sanitary napkins or vaginal tampons, pads for protecting the bed against wetting and similar hygienic products.

It is to be immediately noted that the broad concept of non-woven products comprising biodegradable fibers and a binder with or without padding is notoriously old in the art and the products of the instant invention are to be distinguished therefrom.

In the first place, the vast majority of the binders heretofore employed in the prior art products were water soluble and, in fact, common practice has been to apply the binder to the cellulosic fibers by means of an aqueous solution. The products were subsequently dried so as to remove the water and leave the binder.

The binders contemplated in the finished products of the instant invention must be stable in body discharge during use and obviously, this excludes all water soluble binders. As a matter of fact, body discharge broadly ranges in pH from extremes of about 4.6 to about 8.4 so that the binders of the instant invention must be stable in the slightly alkaline and slightly acidic discharge encountered during use. Quite obviously, the exact pH encountered within the broad range set forth varies depending upon many factors including the specific end use. Thus, diapers and sanitary napkins are not necessarily subjected to the same pH ranges during use. Therefore, the binders employed must be stable only in the particular body discharge encountered during use.

It is to be noted, however, that water soluble binders can be initially used for application to the biodegradable fibers from aqueous solutions thereof providing such binders are subsequently treated to make them water insoluble. Thus, the binder in the finished product must be water insoluble.

Another characteristic of the binders employed in the instant invention is the fact that they be substantially free from irreversible crosslinking, either in the manufacture of sanitary products or in the use thereof. Some of the resins in prior art products were subjected to chemical treatment or significantly high temperatures during manufacture so that they became irreversibly crosslinked. Although this technique does improve the bond between biodegradable fibers such as cellulosic fibers and the resin, it does not result in the production of toilet-flushable articles. As has heretofore been stated, it is an object of this invention to use a binder which is stable in body discharge but which can be degraded in an ordinary toilet upon the addition of a suitable substance. If the binder is irreversibly crosslinked, it becomes very resistant to most substances, i.e., acids, bases, etc. and thus cannot be readily degraded. Accordingly, one very necessary characteristic of the binders employed is that they be substantially free from irreversible crosslinking both during manufacture or use.

It is to be immediately understood, however, that this invention encompasses the use of binders which are only temporarily or reversibly cross linked. Thus, for example, a polymer can be reacted with a metal salt so that it crosslinks, i.e., ionic crosslinking, yet when treated with a suitable degrading agent such as a base, the

crosslinking will reverse itself and the polymer will de-grade.

Another important characteristic of the binders employed in the instant invention is that they be non-irritating to the human body and when combined with cellulose fibers, the resulting product should possess a pleasing hand or feel. It should become immediately apparent that if a binder is employed which is irritating to the human body, it is completely unsuitable irrespective of the fact that it might be stable in body discharge and capable of being degraded in a toilet.

In this connection, a test method has been devised to determine whether or not a candidate binder is non-irritating to the human skin. In this test a sample one inch square is applied to the skin and held in place with adhesive tape. After 48 hours the sample was removed and 10-14 days were allowed to elapse. The test was then repeated for an additional 48 hours. If any redness, scaliness, accumulation of fluid in the skin, etc. occurred, the polymer was considered unsuitable. This test is more fully described in The Public Health Report, vol. 59, 1944 under Prophetic Patch Test at page 551.

Thus, the expression "non-irritating to the human skin" as used in the specification and claims is intended to define a polymer which satisfies the above test procedure.

As has heretofore been noted, the disposable sanitary products of this invention should have sufficient dry strength so that handling, folding or packaging will not tear or puncture them. In this connection, it has been found that the products of this invention can be characterized as possessing a scrim or paper which has a dry, break strength of at least 2.0 pounds. Additionally, in view of the fact that the disposable sanitary products must possess sufficient wet strength to maintain their structural integrity under conditions of use, the scrim or paper must possess a wet strength of at least 0.25 and preferably at least 0.5 pound.

It is also noted that wet and dry strength are not sufficient to characterize a product which is useful as a sanitary product in view of the fact that the degree of elongation or stretch must also be taken into consideration if these products are to function properly. In this connection, it has been found that the products of this invention must possess a dry elongation of from about 3 to about 50 percent and a wet elongation of from about 3 to 50 percent.

The above figures were obtained by the use of a conventional Instron Testing Machine wherein a sample strip one inch by six inches is preconditioned by maintaining it at 73.4° F. and 50% relative humidity for 48 hours. The test strip is then inserted into the rubber-faced jaws of said Instron Testing Machine to a gauge length of two inches and tested at an elongation rate of four inches per minute.

In those situations where the wet strength and wet elongation are desired the sample strip was soaked in water having a pH of about 7 for about 10 minutes after the 48-hour treatment previously referred to and thereafter tested.

The biodegradable fibers incorporated with the binder are not narrowly critical and typical examples include protein fibers, e.g. silk, wool, etc., although cellulosic fibers are preferred. The types of cellulosic fibers employed are also not critical and cellulose is the preferred fibrous material and regenerated cellulose, i.e., rayon, wood pulps of moderate alpha cellulose content and cotton linters represent conventional sources thereof. Additionally, the average fiber length is not narrowly critical and any convenient length can be employed, although it is advantageous to use less than 1/2 inch and even more desirably, less than 1/4 inch.

Numerous polymer substances are known in the art which are stable in body discharge yet are capable of being degraded upon the addition of a suitable degrading agent. Typical examples of these types of polymers would

include those polymers which are stable in neutral or acidic media but which dissolve or degrade in alkaline media. In like manner, polymers are known which are stable or insoluble in neutral or alkaline media but which are soluble or degradable in acidic media. Additionally, polymers are known which are stable in the pH range of body discharge but are capable of being dissolved or degraded by organic solvents such as propylene glycol, phenol, etc. Still other polymers are stable in body discharge but can be degraded by oxidizing agents such as alkaline hypochlorite solutions commonly known as household bleach as well as by perborates and by reducing agents such as alkaline hydrosulfites.

Representative of polymers which are stable in neutral or acidic media but which degrade in alkaline media are copolymers of ethylenically unsaturated mono- and polycarboxylic acids with ethylenically unsaturated esters or nitriles such as copolymers of acrylic or methacrylic acid and an alkyl acrylate or methacrylate, e.g. ethyl acrylate, methyl methacrylate, etc., or with acrylonitrile; carboxy ester lactones; copolymers of alpha, beta, ethylene dicarboxylic acids such as maleic acid and vinyl compounds such as styrene; polyacrylic acid-polyether additives, styrene-monoethyl maleate heteropolymers, itaconic acid polymers, and the like.

The above polymer substances are extremely well known in the art and are described in the literature as well as in U.S. and foreign patents such as U.S. Patents 3,017,291, 3,260,760; German Patents 1,046,884, 1,113,090, 1,125,916, 1,164,095; Belgium Patents 639,010, 621,179, 670,986, 632,629 634,666, 636,162; as well as British Patents 841,312 and 879,950.

In like manner, polymer substances are known which are stable in neutral or alkaline media but which are degraded or dissolved in acidic media. Polymers of this type would include copolymers of aminoacrylates such as dimethylaminomethacrylate and an alkyl acrylate such as ethyl acrylate, polyvinylpyridines, etc. Polymers of this type are also described in various patents including U.S. 3,099,636.

In the practice of this invention a polymer or copolymer above-described is mixed with biodegradable fibers such as cellulosic fibers in accordance with methods well known in the art. With preformed paper webs, it can be sprayed on by conventional spraying methods and then dried. The dried sprayed scrims of this invention have greatly increased wet and dry strength as compared to the corresponding untreated webs and are completely dispersible in water upon the addition of a suitable degrading agent. The resin can also be applied by passing the paper web through nip rolls which are wet with a solution of the resin. The wet web can then be dried in hot air. The resin can also be added during the pulp beating operation. This method, however, is more wasteful of resin since a significant amount will be lost in drainage. All of these methods readily lend themselves to rapid, continuous operation. The mixture of cellulosic fibers and binder are then used to prepare sanitary products in a wide variety of techniques which will be later set forth.

The amount of binder which is employed should be carefully controlled since too little binder will not yield a product of sufficient strength whereas too much binder will result in a product which cannot be degraded in a reasonable time in a toilet. In this connection, it has been found that suitable sanitary products are obtained when cellulosic fibers are held together with from about 10 to about 60 weight percent of a binder.

It is immediately noted that although polymer substances have been described which are degradable by either acids or bases, similar results can ordinarily be obtained with organic solvents such as hydrocarbons or chlorinated hydrocarbons. Thus, just because a polymer is degradable in a base such as, for example, sodium hydroxide, does not preclude it from also being degraded by an organic solvent such as toluene. However, due to

the fact that acids and bases are generally more readily available in the home than organic solvents, the former materials are more preferred as degrading agents.

The absorbent inner core or padding can be composed of foamed cellulose, shredded wood pulp or any other absorbent, water dispersible material. Preferably this material is a cellulosic and most preferably, cellulose. In a preferred embodiment the shredded wood pulp is in the form of a batt as produced, for example, by a Rando-Webber machine (Curlator Company, Rochester, N.Y.).

Foam material suitable for use as the absorbent inner layer can be prepared simply by agitating or foaming a mixture of short length fibers and a wetting agent in water and drying the foam. The nature of the short length fibers is not critical. Cellulose is the preferred fibrous material and wood pulps of moderate alpha cellulose content represent a convenient source thereof. Cotton linters represent another good source. The average fiber length is advantageously less than $\frac{1}{2}$ inch, and desirably less than $\frac{1}{4}$ inch.

In preparing the foam, the relative proportions of fibrous cellulosic material and water should be such as to produce a tractable slurry. Generally this calls for a weight ratio of water to cellulose of at least 10:1. It is critical however that the cellulose constitutes at least 0.7% by weight of the total foam slurry. The nature of the wetting agent is not critical but need only have the properties of forming readily stable bubbles and foam. Preferred wetting agents are the anionic surfactants such as the salts of long-chain sulfites and sulfates such as the sodium sulfate derivative of 3,9-diethyl tridecanol-6 (Tergitol 7), the ammonium sulfate ester of alkylphenoxy-poly (ethylenoxy) ethanol (Alipal CO-346) and the coconut oil acid ester of sodium isethionate (Igepon AC-78). The proportion of foaming agent is advantageously in the range of 0.2 to 1% by weight based on the weight of water in the slurry.

A preferred embodiment of this invention resides in the preparation of disposable sanitary products with either acid degradable or, more preferably, alkaline degradable binders having certain maximum degradable values (D) hereinafter set forth.

It should become readily apparent that those products which are capable of being degraded in a toilet upon the addition of a suitable acid or base in a reasonable period of time, e.g., not to exceed five minutes, will, in fact, be the most useful. Additionally, it would also appear readily apparent that binders which are capable of being degraded by dilute acids or dilute bases are more useful than those which require more concentrated acids or bases for obvious reasons of economy and also to minimize any damage to plumbing including sewerage systems and septic tanks.

In accordance with the above, it has been found that the most useful polymers for the preparation of the novel products of this invention are those which not only possess all the characteristics previously set forth, but also have degradability values (D) no greater than about 5.

Degradability values (D) in accordance with this invention are determined by preparing a sample non-woven scrim strip two inches long and one inch wide consisting of cellulosic fibers less than $\frac{1}{2}$ inch bonded together with 30% by weight of a candidate binder which has been heated to a temperature of 90° C. for about 10 minutes. The sample strip is placed in one liter of water at room temperature to which is added either 2 cc. of 1.0 Normal HCl (if the polymer is acid degradable) or 2 cc. of 1.0 Normal NaOH (if the polymer is degradable in alkaline medium). The test sample is then stirred in either the acid or alkaline solution and the time in minutes for the binder to substantially degrade and release the cellulosic fibers (D) is carefully measured. D values no greater than 5 and even more preferably, no greater than 3 are preferred.

Specific polymers having all the characteristics previously set forth including D values less than 5 would include a copolymer of 80 parts by weight ethylacrylate and 20 parts by weight methacrylic acid. Another suitable binder is a copolymer comprising 60 parts by weight of acrylonitrile and 40 parts by weight methacrylic acid.

As has heretofore been stated, the novel sanitary products of this invention can be prepared according to conventional means with respect to the application of the binders previously described with the cellulosic fibers. Thus, for example, a fibrous web may be formed in any suitable manner such as by carding, garneting, or by dry deposition from air suspension of the fibers and thereafter impregnated with a solution or dispersion of the resin and then oven dried at temperatures sufficiently low to prevent the binder from becoming thermally cross-linked. Although the maximum temperature will vary depending upon the particular binder, nevertheless, it has been found desirable never to exceed temperatures of about 150° C. and even more preferably, to operate at temperatures of from 70 to 120° C. when drying the product.

The bonded cellulosic fiber, scrim or paper previously described can be used to prepare sanitary products in a wide variety of ways according to techniques well known in the art.

The scrim or paper can cover one or both sides of the absorbent inner layer. In one embodiment, one side is covered by a moisture impermeable film. This embodiment precludes the need for a separate supporting garment such as rubber pants since the film keeps the outer surface dry. The nature of the impermeable film is not critical. In a preferred embodiment, it is composed of a material which has water solubility properties similar to that of the resin employed in binding the paper. The film can in fact be one which is cast from the same resinous material employed in the paper. The backing layer can be laminated to the rest of the structure by numerous means apparent to those skilled in the art. This can be conveniently conducted by wetting either the inner layer or film with a binder and then compressing the two layers.

It is noted that reference has elsewhere been made in this specification to the fact that the binder comprises 10 to 60 weight percent of the mixture of the same and the biodegradable fibers. It is to be immediately understood that when multi-layer products are contemplated, e.g. a cellulosic pad covered on both sides with a scrim, that the above percentages apply only to the layer or layers containing both the binder and cellulose fibers. In the above illustration, the percentages apply to the scrim only without any consideration of the pad. Quite obviously, this is necessary since the thickness of the pad can vary and what is critical is the relative proportion of binder and fibers in the scrim and not the proportion of scrim to binder.

The sanitary products of this invention, after use, are merely placed in a regular toilet to which is added suitable degrading agents such as alkalis, acids, oxidizing or reducing agents or organic solvents. Typical examples of alkaline materials would include ammonia, sodium carbonates, ammonium borate and the like. Preferred alkaline materials would include alkali metal borates, phosphates and silicates, e.g. sodium borate, potassium phosphate, potassium silicate, sodium hypochlorite, etc. Typical acidic substances are citric acid, boric acid and acid salts such as calcium and ammonium chloride. Preferred acidic materials include acetic acid, citric acid and dilute hydrochloric acid. Quite obviously, any acid or base can be employed such as dilute hydrochloric acid or dilute potassium hydroxide, but these materials may not be generally found about the home.

Typical oxidizing and reducing agents which can be used are sodium hypochlorite, sodium perborate, sodium hydrosulfite, sodium sulfoxylate and the like. Typical

solvents include propylene glycol, alcohol, phenol and the like.

As has heretofore been stated, the degrading agent interacts with the binder causing it to degrade and the sanitary products are thereafter dispersed in the toilet system by the act of flushing. It is specifically noted that the degrading agent, per se, does not disperse the sanitary products since it substantially only interacts with the binder. The biodegradable fibers are dispersed only upon agitation as is accomplished either by stirring or more simply, by the act of flushing.

It is within the scope of this invention, however, to add the required acidic or alkaline materials in premeasured amounts as tablets, packaged powder or as liquid designed for this specific purpose so as to minimize the inconvenience of stroing, handling and measuring the compounds necessary to degrade the sanitary products.

It is also within the scope of this invention to add perfumes or deodorants in the premeasured degrading agents in order to minimize the unpleasant odors usually encountered in the disposal of sanitary products. It is also noted that perfumes or deodorants can be incorporated into the sanitary structure per se—either in the scrim or in the absorbent padding or in both. Additionally, it is also within the scope of this invention to incorporate into the sanitary products bacteriostatic and dye additives if such is desired.

The following examples illustrate the best mode now contemplated for carrying out this invention.

EXAMPLE 1

60 grams of acrylonitrile and 40 grams of methacrylic acid are mixed together to form a monomer mixture. Four hundred grams of acetonitrile are heated to reflux. One half gram of benzoylperoxide dissolved in acetonitrile is added to the refluxing acetonitrile and the monomer mixture is added over a period of one hour. An additional one half gram of benzoyl peroxide is added and reflux is continued for three hours. The precipitated polymer is recovered, and washed free of acetonitrile.

The precipitated polymer is found to be non-irritating to the human skin. It is found to be substantially free from any crosslinking.

A portion of the above polymer was dissolved in toluene and thereafter applied to a web of cellulose fibers by impregnation and then dried in air at a temperature of about 100° C. to yield a composition comprising cellulose fiber and 30 parts by weight of the above polymer.

A sample strip two inches long and one inch wide was tested for its degradability value (D) in accordance with the procedure set forth in Example 1, and it was found to have a D value of about 2.

A strip 14 inches long by 4½ inches wide was cut from said web and about 20 grams of a non-woven absorbent pad was added to form a diaper. The diaper was found to possess the following physical characteristics.

Dry break strength	-----pounds--	9.5
Wet strength	-----do-----	2.6
Dry elongation	-----percent--	3.8
Wet elongation	-----do-----	10.3

The above diaper was found to be stable in body discharge. However, if after use it is placed in a toilet and two grams of sodium hydroxide are added, it is found that after about 3 minutes the binder was degraded so that the diaper can be safely flushed.

EXAMPLE 2

Alkali soluble polymer for scrim

2400 grams of benzene were placed in a reactor and heated to 80° C. 3 grams of benzoyl peroxide was added

to the reactor and the solution was swept with nitrogen. A solution of 90 grams of styrene, 180 grams of methacrylic acid, 330 grams of 2-ethylhexyl acrylate, and 3 grams of benzoyl peroxide was added to the reactor held at 80° C. over a period of 30 minutes. After one hour at 80° C., 3 grams of benzoyl peroxide was added to the reactor and heating was continued at 80° C. for two hours. The heating of the reactor was then stopped and the reaction was left to cool to room temperature. One to two liters of acetone was added to the cooled reactor and the precipitated polymer was filtered and dried. The dried polymer was dissolved in dioxane and applied to an absorbent unbound cellulose fiber pad to make diapers and sanitary napkins. These products were found to be non-irritating to the human skin and to have D values of 2. The products had the following physical properties.

Dry break strength	-----pounds--	6.4
Wet break strength	-----do-----	0.8
Dry elongation	-----percent--	5.6
Wet elongation	-----do-----	7.8

EXAMPLE 3

Acid soluble polymer

20 grams of ammonium persulfate were dissolved in 50 ml. of water. 11 grams of sodium meta bisulfite was dissolved in 50 ml. of water. These solutions were the initiators used in the polymerization described below.

396 grams of water, 3 grams of Alipal CO-436, 9.8 grams of Igepal CO-977, and 25 grams of Igepal CO-897 were added to the reactor, and nitrogen gas was bubbled through the solution for 15 minutes at 50° C. reactor temperature. 10 ml. each of the initiator solutions were added to the reactor and a comonomer solution of 293.4 grams of ethylacrylate and 72.8 grams of dimethylaminoethyl methacrylate was added to reactor at 40° C. over a two-hour period. The remainder of the initiator solutions was also added to the reactor over a period of two hours. After all the reactants were added, the polymerization reaction was held at approximately 40° C. for ½ hour. The emulsion polymer formed can be used in the Example 3 formulation in place of the 80/20 ethyl acrylate methacrylic acid emulsion copolymer. The binder in the resultant diaper will degrade in acidic media and has a D value of 3.

EXAMPLE 4

350 grams of water and 15 grams of Alipal CO-436 (alkylphenol-ethylene oxide condensation product) were charged to a reactor and heated to 55° C. under a nitrogen gas sweep. A monomer mixture was prepared at 75 grams of methacrylic acid, 75 grams of acrylonitrile, 150 grams of water, 0.3 gram of Cellosize WP-09 (a hydroxyethyl cellulose), and 15 grams of Alipal CO-436 and 150 grams of 2-ethyl hexoacrylate were mixed in a Waring blender for one minute. 25 percent by volume of this mixture was added to the reactor at 55° C. together with 25 percent by volume of separate initiator solutions prepared by dissolving 1.8 grams of ammonium persulfate and 0.9 gram of sodium meta bisulfite respectively in 60 ml. of water. The remainder of the monomer mixture was then added over a 15-minute period and the remainder of each initiator solution was also added over a 30-minute period. The reactor was maintained at about 55° C. for four hours to yield an emulsion polymer.

A web of cellulose fibers was impregnated with 30 weight percent of the above polymer to form a scrim. The scrim was used to cover an absorbent pad of unbound cellulosic fibers in order to make sanitary products such as diapers and sanitary napkins.

The resulting sanitary products had the following properties:

Dry break strength	-----pounds	9.4
Wet break strength	-----do	1.6
Dry elongation	-----percent	6.5
Wet elongation	-----do	8.8
D value	-----	3

EXAMPLE 5

The procedure of Example 2 was repeated with the exception that 15 parts by weight of styrene, 30 parts by weight of methacrylic acid and 55 parts by weight of 2-ethylhexylacrylate were employed. The resulting polymer was then mixed with 50% by weight of cellulose fibers to form a scrim.

When this binder was used to bond cellulosic fibers, a scrim was obtained which possessed excellent physical properties and was suitable for use in the preparation of sanitary products by using the same to cover a padding of unbound cellulosic fibers.

EXAMPLE 6

In a manner analogous to the procedure set forth in Example 2, a binder was prepared by polymerizing a monomer mixture comprising 20 parts by weight of methyl methacrylate, 55 parts by weight of 2-ethylhexylacrylate and 25 parts by weight of methacrylic acid.

When this binder was used to bond cellulosic fibers, a scrim was obtained which possessed excellent physical properties and was suitable for use in the preparation of sanitary products by using the same to cover a padding of unbound cellulosic fibers.

EXAMPLE 7

The procedure of Example 1 was repeated with the exception that 75 parts by weight of methacrylamide were employed instead of the acrylonitrile and 25 parts by weight of methacrylic acid were also used.

When the resulting polymer was used as a binder for cellulosic fibers in an amount of 24% by weight of the total composition, a scrim was obtained which possessed the following physical properties:

	Pounds
Dry break strength	5.6
Wet break strength	0.52

The above scrim could be used to produce sanitary products in accordance with the method of this invention.

EXAMPLE 8

A binder was prepared by copolymerizing 70 parts by weight of 2-ethylhexylacrylate and 30 parts by weight of methyl methacrylic acid in a manner analogous to the procedure set forth in Example 2.

When the resulting polymer was used to prepare a scrim by binding together 69 weight percent of cellulosic fibers a product was obtained which had the following physical characteristics:

	Pounds
Dry break strength	5.2
Wet break strength	0.24

The above scrim was then used to prepare a sanitary product by using it to cover both sides of an absorbent unbound cellulosic fiber pad.

The resulting sanitary product was completely unsuitable for use in that it fell apart during use and it did not retain its structural stability. Its poor performance is attributed to the fact that the wet break strength, i.e., 0.24 pound, was insufficient to give the sanitary product the strength that it needs during use.

EXAMPLE 9

A suitable binder was the butyl half ester of a copolymer of methyl vinyl ether and maleic anhydride.

The polymer resulting from the above copolymerization was utilized as a binder for cellulose fibers in order to prepare a scrim. The scrim had excellent physical

properties and was suitable for the production of sanitary products by using it to cover at least one side of an absorbent cellulose pad.

EXAMPLES 10-12

The following examples will illustrate the preparation of binders and the manufacture of scrims. In each case, the binder is a copolymer of equal parts by weight of styrene and maleic anhydride and the polymers differ from each other in the molecular weight.

50 parts by weight of styrene and 50 parts by weight of maleic anhydride were copolymerized in accordance with conventional techniques well known in the art to produce a polymer having a molecular weight of about 1500. This binder was labeled A.

In like manner, equal parts of styrene and maleic anhydride were copolymerized to yield a polymer having a molecular weight of about 50,000 and this was labeled B.

The same proportion of styrene and maleic anhydride were copolymerized to produce a polymer having a molecular weight of about 20,000 which was identified as C.

Polymers A, B and C were then dissolved in acetone and used to bind cellulosic fibers in order to prepare a scrim. The scrim prepared with polymer A is labeled Example 10, the scrim prepared with polymer B is labeled Example 11; the scrim prepared with polymer C is labeled Example 12.

The above scrims were then evaluated for physical characteristics and found to possess the following properties:

EXAMPLE 10

Weight percent binder	-----percent	45
Dry break strength	-----pounds	4.38
Wet break strength	-----do	1.14
Dry elongation	-----percent	2.2
Wet elongation	-----do	3.2

EXAMPLE 11

Weight percent binder	-----percent	25
Dry break strength	-----pounds	3.92
Wet break strength	-----do	0.11
Dry elongation	-----percent	2.1
Wet elongation	-----do	1.5

EXAMPLE 12

Weight percent binder	-----percent	39
Dry break strength	-----pounds	4.79
Wet break strength	-----do	1.32
Dry elongation	-----percent	2.3
Wet elongation	-----do	3.3

It is to be noted that none of the scrims prepared in accordance with procedures in Examples 10, 11 and 12 yielded satisfactory sanitary products when they are employed to cover one or both sides of non-woven absorbent padding. Thus, the scrim of Examples 10 and 12 did not have sufficient dry elongation. The scrim of Example 11 possessed neither suitable wet break strength, dry elongation or wet elongation.

What is claimed is:

1. A toilet flushable non-woven structure capable of absorbing body discharge comprising water dispersible absorbent material covered at least one side with a scrim characterized by

(a) a dry break strength of at least 2.0 pounds;

(b) a wet strength of at least 0.25 pound;

(c) a dry elongation of from 3 to 50%; and

(d) a wet elongation of 3 to 50%, said scrim comprising biodegradable fibers held together with a binder which is substantially water insoluble, non-irritating to the human body and which is stable in said body discharge; said binder being substantially free from irreversible crosslinking and capable of being degraded and releasing said biodegradable fibers upon

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the addition thereto of a substance which is capable of interacting with said binder and degrading the same.

2. The composition of claim 1 wherein the binder comprises about 10 to about 60 weight percent of said structure and is capable of being degraded in acidic media.

3. The composition of claim 1 wherein the binder comprises about 10 to about 60 weight percent of said structure and is capable of being degraded in alkaline media.

4. A toilet flushable non-woven structure capable of absorbing body discharge comprising water dispersible absorbent material covered at least on one side with a scrim characterized by

- (a) a dry break strength of at least 2.0 pounds;
- (b) a wet strength of at least 0.25 pound;
- (c) a dry elongation of from 3 to 50%; and
- (d) a wet elongation of 3 to 50%, said scrim comprising cellulosic fibers held together with from about 10 to about 60 weight percent of binder which is substantially water insoluble, non-irritating to the human body and which is stable in said body discharge; said binder being substantially free from irreversible crosslinking and having a D value less than 5 and capable of being degraded and releasing said cellulosic fibers upon the addition thereto of a substance which is capable of interacting with said binder and degrading the same.

5. A toilet flushable non-woven structure capable of absorbing body discharge comprising water dispersible absorbent material covered at least one one side with a scrim characterized by

- (a) a dry break strength of at least 2.0 pounds;
- (b) a wet strength of at least 0.25 pound;
- (c) a dry elongation of from 3 to 50%; and
- (d) a wet elongation of 3 to 50%, said scrim comprising cellulosic fibers held together with from about 10 to about 60 weight percent of binder which is substantially water insoluble, non-irritating to the human body and which is stable in said body discharge; said binder characterized as being substantially free from irreversible crosslinking and having a D value less than 5 and capable of being degraded and releasing said cellulosic fibers upon the addition thereto of a base.

6. A toilet flushable non-woven structure capable of absorbing body discharge comprising water dispersible absorbent material covered at least on one side with a scrim characterized by

- (a) a dry break strength of at least 2.0 pounds;
- (b) a wet strength of at least 0.25 pound;
- (c) a dry elongation of from 3 to 50%; and
- (d) a wet elongation of 3 to 50%, said scrim comprising cellulosic fibers held together with from about 10 to about 60 weight percent of binder which is substantially water insoluble, non-irritating to the human body and which is stable in said body discharge; said binder characterized as being substantially free from crosslinking; and having a D value less than 5 and capable of being degraded and releasing said cellulosic fibers upon the addition thereto of an acid.

7. A dispersible diaper comprising the composition of claim 1.

8. A dispersible diaper comprising the composition of claim 4.

9. A dispersible diaper comprising the composition of claim 5.

10. A dispersible diaper comprising the composition of claim 6.

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11. A dispersible sanitary napkin comprising the composition of claim 1.

12. A dispersible sanitary napkin comprising the composition of claim 4.

13. A process for the disposal of non-woven structures capable of absorbing body discharge comprising water dispersible absorbent material covered at least on one side with a scrim characterized by

- (a) a dry break strength of at least 2.0 pounds;
- (b) a wet strength of at least 0.25 pound;
- (c) a dry elongation of from 3 to 50%; and
- (d) a wet elongation of 3 to 50%, said scrim comprising biodegradable fibers held together with from about 10 to about 60 weight percent of binder which is substantially water insoluble, non-irritating to the human body and which is stable in said body discharge; said binder being substantially free from irreversible crosslinking and having a D value less than 5 which comprises placing said structure in a toilet and adding thereto a substance capable of interacting with said binder so as to degrade the same flushing the structure down the toilet.

14. The process of claim 13 wherein the substance capable of interacting with said binder is an acidic compound.

15. The process of claim 13 wherein the substance capable of interaction with said binder is an alkaline compound.

16. A process for the disposal of non-woven structures capable of absorbing body discharge comprising water dispersible absorbent material covered at least one one side with a scrim characterized by

- (a) a dry break strength of at least 2.0 pounds;
- (b) a wet strength of at least 0.25 pound;
- (c) a dry elongation of from 3 to 50%; and
- (d) a wet elongation of 3 to 50%, said scrim comprising cellulosic fibers held together with from about 10 to about 60 weight percent of binder which is substantially water insoluble, non-irritating to the human body and which is stable in said body discharge; said binder being substantially free from irreversible crosslinking and having a D value less than 5 which comprises placing said structure in a toilet and adding thereto a substance capable of interacting with said binder so as to degrade the same flushing the structure down the toilet.

17. The process of claim 16 wherein the substance capable of interacting with said binder is an acidic compound.

18. The process of claim 16 wherein the substance capable of interaction with said binder is an alkaline compound.

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