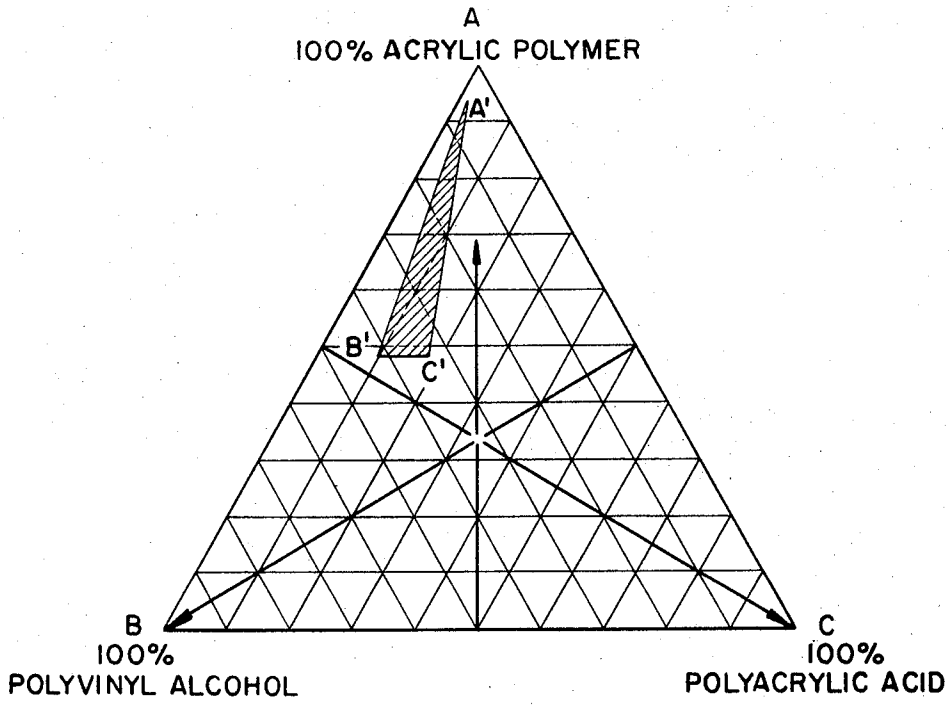
July 3, 1973 G. D. RUSSELL 3,743,536

NONWOVEN SPONGE FABRIC

Filed Feb. 20, 1970



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United States Patent Office 3,743,536 Patented July 3, 1973

3,743,536

NONWOVEN SPONGE FABRIC

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Filed Feb. 20, 1970, Ser. No. 13,174
Claims priority, application Canada, Feb. 25, 1969, 43,961
Int. Cl. B32b *27/06;* D06m *15/00*
U.S. Cl. 117—138.5 15 Claims

ABSTRACT OF THE DISCLOSURE

An absorbent product of improved resistance to discoloration and blocking on sterilization. The product comprises a nonwoven fabric treated with a polycarboxylic acid, a polyvinyl alcohol and an acrylic acid polymer.

This invention relates to absorbent products.

More particularly, this invention relates to absorbent products which are highly absorbent and low in adhesion characteristics suitable for use as surgical sponges.

Surgical sponges are normally composed of several layers of gauze or more recently, one or more layers of nonwoven fabric. The traditional gauze sponges are relatively expensive to manufacture, and unless modified by further treatment, have a tendency to adhere to wounds.

In considering replacement for gauze sponges, nonwoven fabrics have been employed. To a large extent, they overcome the disadvantages of the prior art sponges. However, it has been found that in some cases, non-woven fabrics tend to "block" during steam sterilization and have a tendency to become discolored as a result of the sterilization.

With this invention, applicant has developed a novel nonwoven sponge which overcomes the disadvanages of the prior art gauze sponges, and at the same time, incorporates all of the advantages of the known nonwoven fabrics. Further, the product of the present invention has its own desirable attributes, hereinafter referred to.

According to the present invention, there is provided a nonwoven absorbent product, comprising at least one layer of nonwoven fabric treated with a binder composition consisting of the mixture of (a) a water soluble high molecular weight alcohol capable of insolubilizing a high molecular weight carboxylic acid, (b) a water soluble high molecular weight polycarboxylic acid, and (c) an acrylic polymer.

It has been found that products in accordance with this invention possess low adhesion to wounds, are not blocked during steam sterilization, are highly adsorbent and are softer and more comfortable on a wound. Additionally, the products of the present invention are economical to produce.

The improved properties of the products of the present invention are believed to be attributed to the novel treating composition used, whereby the treating composition imparts to the products the anti-blocking and/or non-discoloration and similar properties. The high molecular weight polycarboxylic acid and the high molecular weight alcohol components are chosen as to be complementary to each other whereby when combined, each has the effect of producing an insolubilized composition.

A preferred alcohol, because of its availability and inexpensiveness is polyvinyl alcohol. Likewise, for the same reasons, a preferred polycarboxylic acid is polyacrylic acid. However, other acids and alcohols having the required properties mentioned above may be employed in accordance with this invention.

The other component of the composition, namely an acrylic polymer, may be any suitable polymer which has the properties, upon being mixed with the other components, of producing a non-hardenable or harsh composition. Typical polymers include polymers of butyl acrylate, ethyl acrylate and mixtures thereof.

The components used in the composition of the present invention may be mixed in any suitable manner to provide the treating product. Preferably, the alcohol and the polycarboxylic acid components are first mixed together and subsequently the resulting mixture blended with the acrylate polymer.

The specific mixture obtained by mixing the three ingredients is believed to form some sort of a reaction product but, the nature of the reaction product or its equilibrium composition in terms of reacted components is not at present fully understood. While not being bound to any particular theory, it is believed that possibly the reaction product is an esterification product which is partially reacted with the methylol groups of the cross-linking acrylate polymer.

In the manufacture of the nonwoven fabric, various types of materials can be employed. Typical of these materials are viscose rayon of deniers below 4.5 denier; cuprammonium rayon of deniers below 4.5 denier; cellulose acetate of deniers below 4.5 denier; cotton (bleached absorbent); polyester of deniers below 4.5 denier; and polypropylene of deniers below 4.5 denier. However, it will be understood by those skilled in the art that other materials may also be employed.

It is preferred, but not essential, that the nonwoven fabric employed in this invention be stabilized against deterioration by incorporating into the fabric during its manufacture, a suitable stabilizer known to those skilled in this art. A typical stabilizer is sodium metabisulfite which may be employed in an amount of from about 0.5% to about 1.0%.

A further preferred feature of the present invention, although also not essential, is the addition of a wetting agent to the fabric to increase the wetting speed. Such wetting agents are known to those skilled in the art and incdlude for example di-octyl sodium sulfo-succinate which is marketed under the trademark "Deceresol OT" or "Triton GR–5." The wetting agent if included may be present in an amount of from about 0.5 to about one percent by weight.

The nonwoven fabrics may be constructed according to known methods of this art as taught by, for example, the procedures taught in Canadian patent 653,278.

Preferably, the nonwoven fabric is of a foraminous type pattern which resembles a gauze. Such a pattern permits freer passage of fluids and/or air through the products, enhancing the applicability for use as surgical sponges. However, other nonwoven fabric patterns may also be employed while still achieving the desirable attributes of the present invention.

The amount of binder composition incorporated into the nonwoven fabrics to provide the fabric with the desirable attributes of the present invention may vary. The amount of binder composition incorporated into the nonwoven fabric, calculated on the basis of a dry solids content, is desirably between 5 and 30%, with a preferred range of 10–15%. However, these figures may vary depending on the particular end product desired.

The binder composition may be applied by any suitable means according to conventional techniques. Such means include passing the nonwoven fabric through a bath of the binder composition or alternately, by printing techniques such as by gravure printing. In printing, the complete nonwoven fabric need not be printed, but only a certain percentage of it—e.g. 35% or less of the fabric surface.

A most preferred composition for use in treating the nonwoven fabrics consists of a mixture of three compo-

nents, namely a cross-linking acrylic emulsion—such as that marketed under the trademark "Rhoplex-HA–8," a solution of a polyvinyl alcohol and a solution of a polyacrylic acid. Such compositions have been found to provide most effective results when it contains, by weight, 20 parts acrylic emulsion solids, 1.6 parts polyvinyl alcohol solids and 0.53 part polyacrylic acid solids.

Referring now to the attached drawing, which represents graphically a preferred range of the three component preferred composition of the present invention, point A designates one component—the acrylic polymer, point B the polyvinyl alcohol and point C the acrylic acid component. Points A, B and C each represent a composition consisting of 100 percent by weight of the individual components.

Preferred copolymers of acrylates for use in the present invention include, for example, ethyl acrylate, butyl acrylate and methylol acrylamide which are cross-linked using heat and catalysts or by heat alone.

The preferred range of materials for the preferred composition is designated within the shaded boundary of the triangular portion A', B' and C'. Within this area, A' represents a composition containing about 93.8%, 4.7% and 1.5% by weight of acrylic polymer, polyvinyl alcohol and acrylic acid respectively. At point B', the composition consists of about 48%, 42% and 10% by weight of acrylic polymer, polyvinyl alcohol and acrylic acid. At point C', the composition consists of about 48%, 34% and 18% by weight of acrylic polymer, polyvinyl alcohol and acrylic acid.

The surgical sponges of the present invention may include absorbent cores or consist essentially of one or more layers of nonwoven fabric folded in a desired manner. If the sponge is fabricated to include a core of absorbent material such as wood pulp fluff or mixtures of wood pulp fluff fibers, e.g. rayon fibers, such products may be prepared according to conventional proceedings. Similarly, the folding of the nonwoven fabric to provide two or more thicknesses of the material may be accomplished according to techniques known in this art.

The treatment of the products to impart the bonding agents to the nonwoven fabrics takes place during the manufacture of the nonwoven fabric.

The following examples will demonstrate preferred embodiments of the present invention.

EXAMPLE 1

A nonwoven fabric having a foraminous type pattern with a weight of approximately 200 grains per sq. yd. was treated with a composition consisting of, in weight percent

	Percent
Acrylic polymer (Rhoplex-HA-8)	93.8
Polyvinyl alcohol	4.7
Acrylic acid (Carbopol 934)	1.5

The above composition was prepared by mixing the above polyvinyl alcohol solution and the acrylic acid solution in the required proportions. This mixture was then added to the emulsion of the acrylic polymer while stirring.

To treat the fabric, the mixture was applied by gravure printing so as to impart to the fabric, a total dry solids pick-up of about 16% by weight.

The treated fabric was then cut into blanks and folded to form surgical sponges.

Samples of the surgical sponges were then subjected to steam sterilization using saturated steam at a temperature of 225° F. for a period of twenty minutes. After twenty minutes the samples were measured and studied for blocking and discoloration. It was found that there was substantially no blocking and, the sponges had a $+b$ value which was less than 8. As compared to samples which were prepared using different bonding agents of the prior art, and which were subjected to steam sterilization, it was found that such prior art samples were blocked and, had a $+b$ value in excess of 11.

The tests used in determining the discoloration are those known in the art and the value of less than 8 represents a very good product whereas a value in excess of 11 represents considerable discoloration.

It will therefore be seen that applicant's products exhibited improved and superior results compared to the prior art.

EXAMPLE 2

Surgical sponges were produced and as are described in Example 1, but in this case, the example employed included a stabilizer in the amount of about ½ percent by weight of the composition. Again, the products were subjected to the sterilization procedures described and the results of Example 1 were repeated with this product.

EXAMPLE 3

Surgical sponges of the present invention were prepared based on the procedures of Example 2. The sponges consisted of a sheet of nonwoven fabric having a grain weight of about 350 grains per sq. yd. The nonwoven fabric was of the type marketed under the trademark "Keybak." The sponges were treated with the components of Example 2. Two series of such sponges were prepared in which sheet material is formed in the 4" by 4", 8 ply thickness and 4" by 4" 6 ply thickness.

Conventional gauzes sponges were also prepared which consisted of several layers of gauze folded to form 4 by 4 inch size products.

The two series of products according to the present invention, and the conventional gauze sponges, were then used in a plurality of repetitive tests to determine their adherence to wounds. As a result of these tests, it was found that wound adherence by the products of the present invention was substantially non-existent, whereas with the conventional gauze sponges, there was evidence of wound adherence in almost all cases.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An absorbent product having improved resistance to discoloration and blocking on sterilization comprising at least one layer of nonwoven fabric, said fabric having been treated with a composition consisting of from 1.5% to 18% of a high molecular weight polycarboxylic acid, from 4.7% to 42% of a polyvinyl alcohol, and from 48% to 93.8% of a polyacrylate.

2. The product of claim **1** wherein said nonwoven fabric includes a stabilizer to prevent deterioration.

3. The product of claim **1** wherein said nonwoven fabric includes a wetting agent.

4. The product of claim **3**, wherein said composition consists of, prior to treating said absorbent product, approximately 93.8%, 4.7% and 1.5% by weight of said polyacrylate, polyvinyl alcohol and polyacrylic acid respectively.

5. The product of claim **3**, wherein said composition consists of, prior to treating said absorbent product, approximately 48%, 42%, and 10% by weight of said polyacrylate, polyvinyl alcohol, and polyacrylic acid respectively.

6. The product of claim **3**, wherein said composition consists of, prior to treating said absorbent product, approximately 48%, 34% and 13% by weight of said polyacrylate, polyvinyl alcohol and polyacrylic acid respectively.

7. The product of claim **1**, wherein there is included a stabilizer which is sodium metabisulfite.

8. An absorbent product having improved resistance to discoloration and blocking on sterilization comprising at least one layer of nonwoven fabric, said fabric having been treated with a composition consisting of a mixture of polyvinyl alcohol, polyacrylic acid and a polyacrylate consisting of the group ethyl acrylate-methylol acrylamide

copolymer, butyl acrylate-methylol acrylamide copolymer, and copolymers of ethyl and butyl acrylate possessing cross-linking functionality, the amounts of the components of said composition being correlated to fall within the range of from 4.7% to 42% polyvinyl alcohol, 1.5% to 18% polyacrylic acid and 48% to 93.8% polyacrylate.

9. The product of claim **8** wherein said nonwoven fabric includes a stabilizer to prevent deterioration.

10. The product of claim **1**, wherein there is included a stabilizer which is sodium metabisulfite.

11. The product of claim **8**, wherein said nonwoven fabric includes a wetting agent.

12. The product of claim **8**, wherein said composition prior to treatment of said absorbent product, includes 20 parts by weight of cross-linking acrylic emulsion solids, 1.6 parts by weight of polyvinyl alcohol solids and .53 part by weight of polyacrylic acid solids.

13. The product of claim **11**, wherein said composition consists of, prior to treating said absorbent product, approximately 93.8%, 4.7% and 1.5% by weight of said polyacrylate, polyvinyl alcohol and polyacrylic acid respectively.

14. The product of claim **11**, wherein the composition consists of, prior to treating said absorbent product, approximately 48%, 42%, and 10% by weight of said polyacrylate, polyvinyl alcohol and polyacrylic acid respectively.

15. The product of claim **11**, wherein said composition consists of, prior to treating said absorbent product, approximately 48%, 34% and 13% by weight of said polyacrylate, polyvinyl alcohol and polyacrylic acid respectively.

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U.S. Cl. X.R.

117—138.8 E, F, 140 A, 143 A; 128—296; 260—901