SOLUBLE COATED PAPER


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UNITED STATES PATENTS

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3,123,075 3/1964 Stamberger 128/287


3,431,166 3/1969 Mizutani et al. 162/135

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ABSTRACT

A soluble paper having a coating of polyvinyl alcohol. The soluble paper comprises carboxy methyl cellulose, and the sodium or potassium salts of carboxy methyl cellulose. The coated paper is soluble in either high or low temperature water.

4 Claims, 7 Drawing Figures
SOLUBLE COATED PAPER

This invention relates to a soluble paper, and more particularly, to a soluble paper that is coated with a polyvinyl alcohol film.

Water soluble or disintegratable paper is known to the art. Such paper is disclosed in U.S. Pat. No. 3,431,166, the disclosure of which is incorporated by reference herein.

Polyvinyl alcohol (hereinafter referred to as PVOH) is known, water-soluble plastic. It has been used in packaging many items wherein the package is intended for subsequent dissolving. Thus, it has been used in packaging soap and detergent, with the entire package being placed in a washing machine. When the washing machine is filled with water, the package will dissolve and the detergent will be distributed in the washing water. In this way, exact predetermined amounts of soap or detergent can be placed in the washing machine.

A number of problems have developed when utilizing the pouches formed from PVOH. One of the problems is that PVOH is hygroscopic. Thus, it will attract water to its surface, and when a number of packets of PVOH are stacked, they will stick together. This renders the separation of the packets difficult, and renders the use of these packets in dispensing machines almost impossible. Thus, single packets cannot readily be dispensed from a stack of the packets in the dispensing machine.

Additionally, PVOH has little dimensional stability. Therefore, when materials having substantial weight are placed in the PVOH packets, the packets have a tendency to distort or elongate. This creates dispensing and storage problems.

The water-soluble paper will readily dissolve or disintegrate in water. However, its uses are limited in that it cannot be used for packaging liquids. Additionally, the making of packets is difficult since the paper cannot be heat sealed, and must be glued. The use of the glue in many cases renders the dissolving of the paper more difficult.

In the invention of this application, the dissolvable paper is coated with PVOH. The coated paper finds many uses and advantages which could not be obtained from either the PVOH or the paper alone. One of the prime advantages is that the coated paper can be heat sealed. There is complete dimensional stability added to the PVOH by the backing sheet of paper. When the packets are made from the coated paper, the PVOH is on the interior. Therefore, there is no fear of sticking of packets, since the contacting surfaces of stacked packets are the paper.

Additionally, the packets formed from the coated paper can be used in the storage of liquid, since the PVOH is liquid impermeable. The formulation of the PVOH can be controlled to render the PVOH soluble only at high temperatures, in the order of 140°F.

The coated paper of this invention finds numerous hospital, medical, industrial and consumer uses. It can be used for bedpan liners, urinal bags, sick bags, in a soluble bedpan, portion packets, aprons, surgical gowns, caps and overshoes, medical sheeting, labels, etc.

It is therefore an object of this invention to provide a novel, soluble coated paper.

It is another object of this invention to provide a soluble, disposable bedpan.

It is a further object of this invention to provide a liquid impermeable, water-soluble pouch.

These and other objects of this invention are accomplished by providing a water-soluble sheet material comprising a watersoluble paper having a film of polyvinyl alcohol coated thereon.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view of a disposable bedpan embodying the paper of this invention;

FIG. 2 is an enlarged sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a perspective view, partially broken away, showing the structure forming the base of the bedpan of FIG. 1;

FIG. 4 is a perspective view showing the method of disposing of the bedpan of FIG. 1;

FIG. 5 is a perspective view of a pouch adapted to receive and store urine, and usable with the bedpan of FIG. 1;

FIG. 6 is an enlarged sectional view taken along the line 6—6 of FIG. 5; and

FIG. 7 is a schematic view showing the method of forming the coated paper of this invention.

Referring now in greater detail to the various figures of the drawings wherein like reference characters refer to like parts, a water-soluble paper embodying the present invention is generally shown at 10 in FIG. 7. Paper 10 basically comprises a sheet of dissolvable paper 12 having a film of PVOH 14 coated thereon.

The dissolvable paper 12 is made in accordance with the teachings of U.S. Pat. No. 3,431,166. As explained in detail in said patent, the paper comprises cellulose-glycolic acid (carboxy methyl cellulose, hereinafter referred to as CMC-H) which has been partially substituted with a sodium salt of potassium salt of the acid (said salts hereinafter referred to as CMC-Na or CMC-K, respectively). The degree of substitution is within the range of 0.1 to 0.8.

The PVOH can either be low temperature soluble (i.e., the temperature of cold tap water), or high temperature soluble (i.e., 140°F) above 212°F. The method of varying the solubility temperature of the PVOH is well known in the art. By way of summary, the completer the hydrolysis of polyvinyl acetate in the formation of the PVOH, the higher the temperature for solubility.

Briefly summarized, the PVOH is formed by reacting polyvinyl acetate, methyl alcohol and sodium hydroxide in a catalyst of sodium methylene. In the reaction, the acetate groups are replaced with hydroxyl groups. As pointed out above, the more complete the hydrolysis, the higher the temperature needed for solubility. Conversely, the greater the amount of acetate groups in the PVOH, the lower the temperature for solubility. The PVOH that is soluble in water at 138°F and above is 99 to 100 percent hydrolyzed.

The method of making the coated paper is shown in FIG. 7. As seen therein, a solution of PVOH and water 16 is placed in a trough 18. The solution comprises approximately 26 percent PVOH and 74 percent water. The trough 18 is positioned above a continuous conveyor 20.

In the process, the PVOH-water solution 16 is deposited upon the conveyor 20 when the conveyor is moving in the direction of arrow 22. The conveyor is pro-
vided with a non-stick surface, such as polytetrafluoroethylene or silicone rubber. Alternatively, a silicone release agent can be continuously sprayed on the conveyer prior to the depositing of the PVOH-water solution.

The PVOH-water solution is deposited at a pre-set thickness, such as 3 mils. Thereafter, the material is reduced to about one-half its original thickness by a doctor blade, leaving PVOH film, which is still in a liquid state. The soluble paper 12 is then brought into contact with the liquid film 14, and squeezed out of the film by a pressure roller 26. This forces the PVOH into the interstices of the paper 12, thereby coating the paper and leaving a surface film of PVOH.

The water-soluble paper having the PVOH coating thereon then passes along the conveyer 20 and into oven 28. Any type of oven known to the art can be used for drying the coated paper. As shown schematically in FIG. 7, the oven includes a motor 30 having leads 32. The motor drives a fan within the oven, which fan circulates hot air around the coated paper. Any means known to the art can be used for heating the air, such as electric resistance heaters. After the coated paper has been dried, it is removed from the conveyer, as indicated by arrow 34. The paper can then be rolled, folded, cut or otherwise handled for storage and subsequent usage.

One of the principal uses of the coated paper is in the formation of pouches for storing both liquids and solids. An example of a pouch that can be formed from the coated paper is generally shown at 36 in FIG. 5. Pouch 36 can be used for storing any materials, and can assume any desired shape. In the embodiment shown in FIG. 5, the pouch 36 is adapted for the reception and storage of urine. As seen in FIG. 6, the pouch is formed from two pieces of the coated paper of this invention. The paper 38 is outermost and the coated film 40 of PVOH is on the inner side. The two pieces are cut to the desired shape and are heat sealed around substantially the entire perimeter, as shown by heat seal 42.

One of the features of this invention is the fact that the PVOH is heat sealable. Thus, the heat will pass through the paper film 38 and cause the flow of the PVOH to form the seal or bead 42. As seen in FIG. 5, one end of the pouch 36 remains opened and unsealed. The urine is passed through the opening 44 at this end.

Once the pouch 36 has been filled with urine, it can be sealed by any means known to the art. By way of example, a water-soluble, pressure sensitive adhesive 46 surrounds opening 44. Of course, in order to prevent the premature sealing of the pouch 36, removable protective strips are placed on the pressure sensitive adhesive, and the strips are removed after the bag has been filled.

Any of the water-soluble, pressure sensitive adhesives known to the art can be used for this purpose. Generally, these adhesives comprise a latex and a tackifier with a small amount of rubber anti-oxidants. Latexes that can be used are polyisobutylene, butyl rubber, BunaN, polyvinyl ethers or polyacrylate esters.

The tackifiers can comprise polyterpine resins, gum rosin, rosin esters, coumarone-indene resins or petroleum hydrocarbon resins. The anti-oxidants can comprise aromatic amines, substituted phenols or substituted quinolins.

The pressure sensitive adhesive is only one means of sealing the pouch 36. The pouch can also be heat sealed or closed with a tie string formed from the coated paper of this invention. Where the pouch is used for storing materials that are later placed in water, such as soaps and detergents, the pouch will be heat sealed prior to delivery to the ultimate user.

A disposable bedpan that can be used with the disposable paper of this invention is generally shown at 48 in FIG. 1. Disposable bedpan 48 basically comprises a base 50 and a lid 52 that is hingedly secured to the base.

Base 50 is rigid and includes a large receptacle 54 and a smaller receptacle 56 therein. Base 50 is formed from heavy-duty dissolvable paper 12. As seen in FIG. 3, the base comprises a plurality of convolutions or corrugations 58 of the dissolvable paper 12. It should be noted that these convolutions do not carry the PVOH coating on the paper. The convolutions are adhesively secured at their contiguous points 60 forming a honeycomb. Any water base adhesive can be used for this purpose, such as polyvinyl acetate or sodium silicate. The convolutions 58 give rigidity to the base 50. They are covered on their tops bottoms and sides by water-soluble paper 62, which is identical to the paper 12. Paper 62 is adhesively secured to the convolutions 58.

As seen in FIG. 2, the paper 62 passes into receptacle 54. The receptacle 54 is provided with a liner 64 which comprises the coated paper 10. The PVOH side of the paper is uppermost, and the soluble paper side 12 is adhesively secured to paper 62 by a water base adhesive to maintain the liner 64 in place. The PVOH used in liner 64 is the high temperature grade. Receptacle 56 is unlined.

Lid 52 is formed from corrugated dissolvable paper 12 having surface sheets on the top and bottom of the corrugations. The lid 52 is hingedly secured to the base 50 by a tape 66 that comprises the dissolvable paper 12. Tape 66 is held in place by a water base adhesive such as that described above. A strip 68 of water-soluble paper 12 passes across lid 52 and is adhesively secured in place by a water base adhesive. Three sheets 70 of tissue grade dissolvable paper 12 are held against lid 52 by strip 68. A strip 72 of dissolvable paper 12 is adhesively secured to lid 52 by a pressure sensitive adhesive 74. The exposed portion of the adhesive 74 is to be provided with a removable strip which protects the pressure sensitive adhesive until it is used. The pressure sensitive adhesive 74 can be any of the water-soluble pressure sensitive adhesives specified above.

The bedpan 48 is used in the conventional manner. The human excrement will be deposited in receptacle 54. Since high temperature PVOH comprises the exposed surface of the liner 64, the urine deposited in the receptacle 54 will not dissolve the PVOH. Thus, it could be understood that urine has the same temperature as the human body, which is well below the 138°F dissolving temperature for the liner 64. The necessary tissue is removed from the strip 68 and deposited in the receptacle 54. The urine pouch 36, if used independently of the receptacle 54, is sealed and placed in the receptacle 56.

After the bedpan 48 has been used, lid 52 is pivoted in the direction of arrow 76 until the lid 52 is flush with the top surface of the base 56. At this point, the protective strip is removed from adhesive 74 and the lid 52 can be sealed in place by the strip 72. Thereafter, the bedpan 48 is placed in a receptacle 78 (FIG. 4), which is filled with warm water 80. The water must be at a
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temperature of a minimum of 140°F. The higher the temperature, the more quickly the bedpans will dissolve. The higher the temperature, the more quickly the bedpans will dissolve. It is thus seen that a completely sanitary bedpan is provided. It is low in cost, and there is no fear of infecting patients since the bedpans are used only once. Sterilization of bedpans is eliminated. Human hands need never come into contact with the contents of the bedpans, and this prevents the passage of infection from one bedpan to another during the cleaning process.

Another feature of this invention is the incorporation of novel plasticizers in the PV0H. Plasticizers that had previously been used were fugitive in nature, that is, they migrated out of the PV0H, and left the PV0H in a brittle state. The plasticizers used in the PV0H of this invention do not migrate. Because of this, the PV0H provides a better heat seal and will not become brittle after long standing.

The new plasticizers can be selected from the group consisting of glycerine, glycols, such as ethylene glycol, and sorbitol. Preferably, the plasticizer will comprise 3 to 5 per cent of the PV0H, with a maximum range being approximately 2 to 7 per cent of PV0H, by weight.

In the process shown in FIG. 7, the coated paper is in the oven 28 for a sufficient period of time to drive off all of the water in the PV0H-water solution. This can be accomplished at a temperature of 250°F and a dwell time in the oven of 5 to 7 minutes. Of course, the temperature and dwell time will vary depending on the thickness of the PV0H film and the thickness of the paper 12. A preferred thickness for both the paper and the PV0H film is 1.5 mils for each, or a total thickness of 3 mils.

The paper, both in the coated and uncoated state, can be made in any desired thickness. In the bedpan, it has been found that a paper of 7 mils in thickness will give the desired strength to the base to form the honeycomb construction to readily support the weight of the human body when the bedpan is used. A preferred thickness for the coated paper, such as for use in pouches, is approximately 3 mils. Paper of this thickness has all the necessary structural and tear strength, while at the same time being thin enough for ready dissolving and for facility of heat sealing. If the paper is much thicker than 1.5 mils when used in the coated state, heat sealing is rendered more difficult, since the sealing must be through the paper to the PV0H, as shown in FIG. 6.

A PV0H film has been applied as an laminate on the soluble paper using a water-soluble adhesive. However, it has been found that the coated paper is far superior to the paper laminated with a sheet of PV0H. Among the problems of the laminate are the fact that a water plasticizer was used in making the PV0H sheets, and this is a fugitive plasticizer. Thus, the laminate became brittle as the PV0H became brittle.

Another problem with the laminate is that it did not heat seal well. This could possibly result from the fact that the adhesive layer inhibits the heat-sealability of the laminate.

Another problem with the laminate is that delamination often occurred. This resulted from too little adhesive. If too much adhesive was used, the soluble paper became clogged, and this resulted in slow dissolving.

Therefore, the amount of adhesive used in the laminate was critical.

None of the foregoing problems exist with the coated soluble paper. It is for these reasons that the coated paper is superior to the laminated paper.

The pouches formed from the paper of this invention have numerous uses. For instance, they can be used for the collection and storage of urine, as shown in FIG. 1. They can also be used as portion packets which are later dissolved, such as packets for soap, detergent or bleach. They can also be used for industrial packaging.

Wherever liquid is stored in the pouches, the coated paper must be used for forming the pouches, and the PV0H surface must be on the interior, as seen in FIGS. 5 and 6. However, where dry materials, such as powdered bleach or detergent, are used, a slightly modified form of the pouch can be made. In the modified form, one half of the pouch is formed from the coated paper and the other half of the pouch is formed from the uncoated paper 12. Accordingly, a sheet of the coated paper is placed against a sheet of the uncoated paper, with the uncoated paper being contiguous with the PV0H side of the coated paper. Thereafter, a pouch is formed by applying heat around the edge of the two sheets of paper, whereby the PV0H will flow into the interstices of the uncoated paper, thereby forming a permanent seal.

The advantage of the modified form of the pouch is that it will dissolve in ten to fifteen seconds in 75°F water. A similar pouch made from two plys of the coated paper will take from 1 to 2 minutes to dissolve in 75°F water. It is thus seen that for many uses, two pllys of the coated paper need not be used for forming the pouch. However, it should be noted that all of the advantages of the coated paper are obtained by forming a pouch from one sheet of coated paper and one sheet of uncoated paper. Thus, the pouch can still be heat sealed during its formation. Likewise, the dissolvable paper adds dimensional stability to the PV0H, and in addition, the hydrosopic problem of the PV0H is eliminated, since the exterior of the pouch or packet comprises the dissolvable paper.

Packages made from the coated paper of this invention enjoy many advantages. Exact, pre-measured quantities can be packaged. Handling is facilitated because the packages do not have to be torn open, since they are readily dissolved. There is no need to handle dangerous chemicals, since the chemicals will be completely contained within the packages.

Trash resulting from used packaging material is eliminated, since the packaging material is dissolved in use. Additionally, the dissolving packaging material acts as a thickening agent. Cleansing action is increased when detergents are packaged, since the dissolved coated paper will act to suspend dirt in the wash water.

All types of industrial chemicals can be packaged in packets or pouches formed from the coated paper of this invention, such as dyestuffs, organic chemicals, dry powdered chemicals and water based chemicals. Agricultural materials, such as fungicides, insecticides, herbicides, fertilizers and soil sterilants, can be packaged in the coated paper of this invention. Household materials that can be packaged in the paper are bleaches, detergents, bubble bath and swimming pool chemicals.

When the high temperature PV0H is used as the coating material, the coated paper can be used in such items as urinal bags, sick bags, the bedpan disclosed
herein and bedpan liners. Additionally, many surgical items can be made from the coated paper such as gowns, caps, overshoes, specialized medical sheeting and aprons.

The coated paper can be cut and sealed into any shape using standard hot bar heat sealing equipment. The surface texture provides sharp, clear, clean multiple color impressions using dry offset, letterpress and other printing processes.

Without further elaboration, the foregoing will so fully illustrate my invention that others may, by applying current or future knowledge, readily adapt the same for use under various conditions of service.

What is claimed as the invention is:

1. A water soluble sheet material comprising a water soluble paper having a film of polyvinyl alcohol coated thereon, said film being impregnated into the interstices of said paper, said film being insoluble in water which is at a temperature below approximately 138°F, but being soluble in water above approximately 138°F, and said water soluble paper comprising carboxy methyl cellulose that is substituted in the range from 0.1 to 0.8 with an alkali metal salt of carboxy methyl cellulose.

2. The sheet material of claim 1 wherein said polyvinyl alcohol is plasticized with a plasticizer selected from the group consisting of glycerine, ethylene glycol and sorbitol.

3. The sheet material of claim 2 wherein said plasticizer is present in the range of 2 to 7 per cent, by weight, of polyvinyl alcohol.

4. The sheet material of claim 2 wherein said plasticizer is present in the range of 3 to 5 per cent, by weight, of polyvinyl alcohol.

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