

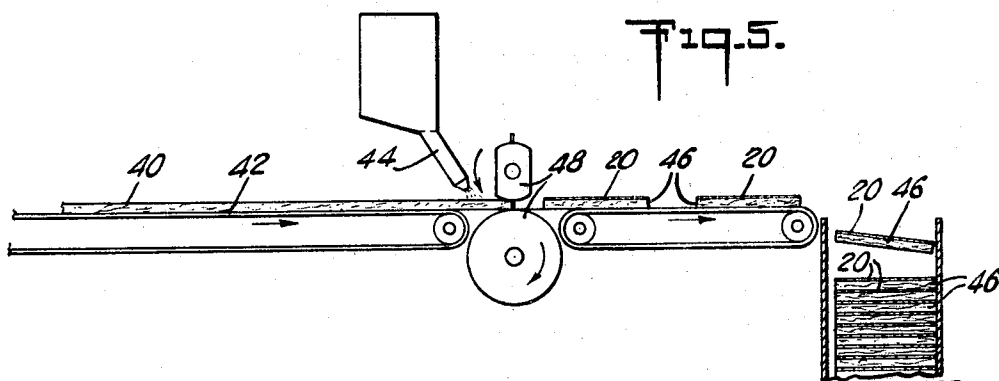
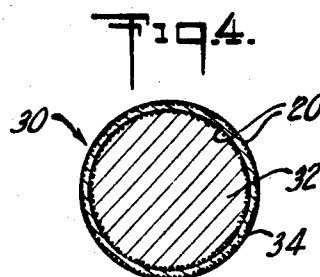
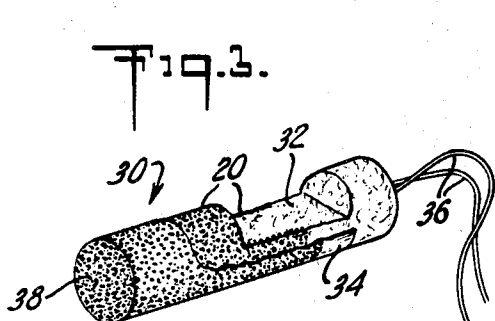
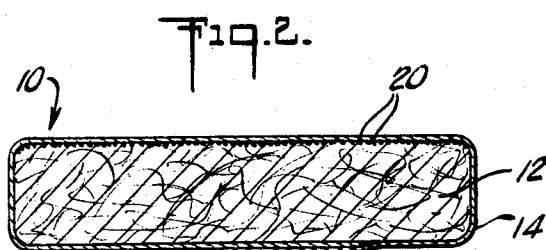
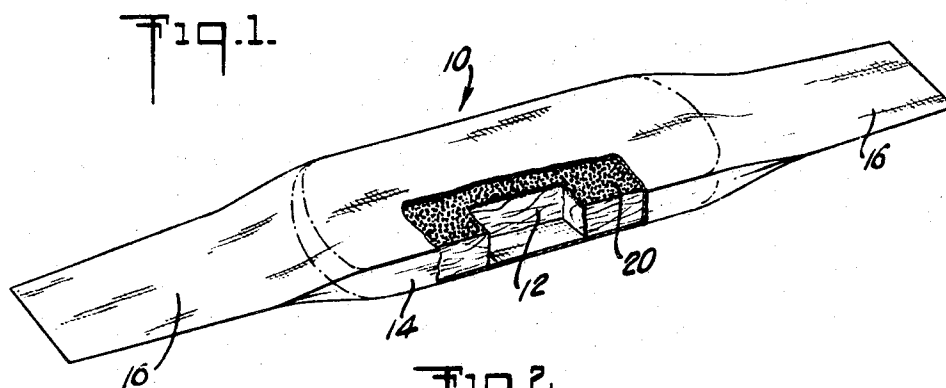
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CATAMENIAL PAD WITH AN ENZYME THEREON

Filed Feb. 28, 1966



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3,386,441
CATAMENIAL PAD WITH AN ENZYME
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This invention relates to absorbent fibrous products and more particularly, is directed to an improved catamenial pad.

Catamenial pads, i.e. sanitary napkins, tampons, and interlabial pads, usually consist of a core of one or more layers of highly absorbent, relatively dense fibers which has a fluid permeable, soft, knitted, woven or nonwoven wrapper. The cores are conventionally made of layers of fibers such as: carded cotton webs, air-layered cellulosic fiber webs, comminuted wood pulp bats, tissue pulp or like materials which are highly absorbent.

By the present invention, I have found a novel mechanism and means which provide more effective absorption of menstrual fluids in the absorbent core portion of catamenial pads made from the above fibrous materials.

According to the present invention, there is provided a catamenial pad having a relatively thick absorbent core of fibrous material surrounded by a liquid pervious fibrous cover and which has within the fibrous structure, on at least a portion of the surface area thereof, one or more enzymes having proteolytic, mucolytic and amylolytic activity applied thereto at the rate of from about 0.3 milligram per square centimeter to about 2.0 milligrams per square centimeter. The enzymes serve to liquify gels and mucoid materials found in menstrual discharge which, if not liquified, tend to obturate the pores of catamenial pads. Liquifying the gels and mucoid constituents of menstrual discharge appreciably increases fluid penetration into the catamenial pad thereby greatly increasing their in-use absorptive capacity.

These and other features and attendant advantages of the present invention will be apparent from the following description when taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective view of a sanitary napkin shown partially open to illustrate the incorporation of the invention;

FIGURE 2 is a cross-sectional view taken on line 2—2 of FIGURE 1;

FIGURE 3 is a perspective view of a catamenial tampon shown partially open to illustrate the incorporation of the invention;

FIGURE 4 is a cross-sectional view taken on line 4—4 of FIGURE 3; and

FIGURE 5 is a schematic flow diagram illustrating the incorporation of enzymes into the catamenial pads of the present invention.

Referring now to the drawings, first to FIGURES 1 and 2, a sanitary napkin 10 incorporating the invention includes a relatively thick elongated absorbent core 12 enclosed within a liquid pervious fibrous wrapper 14 whose ends extend beyond the ends of the absorbent core to provide the usual attachment tab 16. The absorbent core can be about 8 inches long, 2½ inches wide and ½ inch thick and can consist of one or more layers of fibrous material such as: carded cotton webs, air-layered cellulosic fiber webs, comminuted wood pulp bats, tissue pulp or like materials which are highly absorbent. There can also be included within the absorbent

core 12 one or more layers of semirepellent sheets such as: sulphite creped paper or absorbent layers of bleached sulphite paper wadding and the like. The entire core assembly is enclosed within the liquid pervious fibrous wrapper 14.

In the sanitary napkin embodiment illustrated in FIGURES 1 and 2, the fibers at the top surface of the absorbent core 12 have applied thereto an enzyme 20 suitable for liquifying menstrual fluid gels and mucoid constituents. The embodiment shown with the enzyme applied to the fibers on one surface of the absorbent core illustrates a so-called "one way" napkin. That is to say, the napkin is worn with the surface of the absorbent core containing the liquifying enzyme positioned towards the body. However, it is to be understood that a so-called "two way" napkin can be made in accordance with the present invention by applying the liquifying enzyme to the fibers on both the top and bottom surfaces of the absorbent core. In this instance, either side of the napkin can be positioned against the body of the wearer.

Referring now to FIGURES 3 and 4, there is illustrated a catamenial tampon 30 incorporating the invention and which includes an elongated cylindrical core 32 of densely packed absorbent fibers enclosed within a liquid pervious fibrous wrapper 34. Secured at one end of the tampon are a pair of withdrawal strings 36 by which the tampon can be withdrawn subsequent to use.

In the tampon embodiment shown, the enzyme 20 or enzymes are applied to the fibers on the surface of the densified fibrous core 32 and to the fluid pervious fibrous cover 34 surrounding the core. As illustrated, the enzyme 20 is applied to the surface of the tampon from the end 38 first to be inserted into the vaginal opening and extends along the longitudinal direction of the tampon 30 for about ¾ of its length. It is to be understood, however, that the enzyme could be applied to the total surface of the absorbent core 32 of the tampon 30 and/or the total surface of the fluid pervious fibrous wrapper 34. However, since the tampon 30 intercepts menstrual fluid from the end 38, it is most important that the gels and mucoid constituents of the menstrual fluid be fluidized by the enzyme present in the tampon in the area first to be contacted by the menstrual fluid.

TABLE I

Enzyme (commercial name)	Type	Class	Manufacturer or distributor
Chymotrypsin.....	Protease.....	Animal....	Armour Pharmaceutical Company, Kankakee, Illinois
Crystalline Porcine Trypsin.....	do.....	do.....	Enzyme Dev. Corp. Division of Biddle Sawyer Corp., New York, N.Y.
Papain 350.....	do.....	Vegetable.	Blackman Laboratories, South Hack- ensack, N.J.
Capazyme.....	do.....	do.....	Wallerstein Labs. Division of Baxter Labs. Inc., Staten Island, N.Y.
Prolase 300 Z.....	do.....	do.....	Enzyme Dev. Corp., Division of Biddle Sawyer Corp., New York, N.Y.
Panol.....	do.....	do.....	Rohm & Haas, Philadelphia, Pa.
Panol Mg-Ca.....	do.....	do.....	
EB-21.....	do.....	Bacterial	
Rhozyme J-25.....	Protease and Diastase.	do.....	
Rhozyme P-11.....	do.....	do.....	
Rhozyme W-15.....	Protease.....	do.....	Enzyme Dev. Corp., Division of Biddle Sawyer Corp., New York, N.Y.
Protease 43.....	do.....	do.....	
Protease 43 Cone.....	do.....	do.....	
Bacterial Protease.....	Protease and Amylase.	Bacterial..	
NOVO.....	Protease and Diastase.	do.....	
Bioprase #00379.....	do.....	do.....	Enzyme Dev. Corp., Division of Biddle Sawyer Corp., New York, N.Y.
NAGARSE.....	Protease.....	do.....	

The particular enzymes used in accordance with the present invention must be those which liquify the gelatinous and mucoid constituents of menstrual fluids while at the same time, are nonirritating to the skin and vaginal mucosa. Suitable enzymes I have found, belong to the animal, vegetable and bacterial classes and have proteolytic, mucolytic and amylolytic activity. Such enzymes are listed in the above Table 1 grouped according to their type of origin. The commercial names and the manufacturer or distributor from whom the enzymes are available are also provided.

Particularly suitable of the enzymes listed above, are the bacterial enzymes identified above as "EB-21," "Protease 43 Concentrate" and "NOVO" and the vegetable enzyme identified as "Prolase 300 Z."

The enzymes used in accordance with the present invention are applied to the surfaces of the absorbent cores or to the wrappers of catamenial pads preferably in powdered form by means of an aerosol spray preferably employing "Freon" propellant or other substantially inert solvent. However, the enzymes can be applied to catamenial pads in accordance with the present invention from an aqueous suspension or solution of the enzyme but this method is less desirable inasmuch as it requires drying of the catamenial pad subsequent to the application of the enzyme.

There is illustrated in FIGURE 5, one method of applying the enzymes of the present invention to absorbent fibrous material. A relatively thick fibrous bat 40, suitable for forming the absorbent core in a sanitary napkin, is conveyed continuously on a continuous belt conveyor 42 adjacent to an aerosol spray apparatus 44 directing its spray over the top surface of the fibrous bat 40. From the conveyor 42 and subsequent to the application of the enzyme to the upper surface of the fibrous bat 40, it is cut into pads 46 of suitable length for use in a sanitary napkin by rotary cut-off apparatus 48 and thence is conveyed away therefrom to further processing apparatus 50 where the sanitary napkin can be covered by a fluid permeable fibrous cover which may or may not also have an enzyme applied thereto.

Similarly, fibrous material formed into catamenial tampons can be conveyed past an aerosol spray station for the application of an enzyme to the surface of its compressed fibrous core or to the surface of the fluid permeable fibrous wrapper applied thereto. The enzyme can be applied to the catamenial tampon before the fluid permeable wrapper is placed thereon or the enzyme can be applied after the wrapper is placed around the core thereby applying the enzyme only to the cover. Similarly, the enzyme can be applied to the cover material prior to its being wrapped around the absorbent core of the tampon.

Application of the enzyme to the fibers in the surface of the cores of the catamenial pads or to the fibers in the covers of the catamenial pads or both is controlled to a rate such that the enzyme is present on the surface thereof in an amount ranging from about 0.3 milligram per square centimeter to about 1.0 milligram per square centimeter. Most preferred is an enzyme concentration of about 0.6 milligram per square centimeter. It will be understood, that if the enzyme is applied both to the fibers on the surface of the absorbent core and to the fibers in the fluid pervious cover, the enzyme will be present in an amount ranging from about 0.6 milligram per square centimeter to about 2.0 milligrams per square centimeter with about 1.2 milligrams per square centimeter being most preferred.

The present invention will be even more clearly understood from the following examples:

Example I

A sanitary napkin is prepared having an absorbent core of comminuted wood pulp and a nonwoven porous cover. The upper surface of the wood pulp core has

applied thereto 0.6 milligram of "EB-21" enzyme per square centimeter of surface area. The enzyme is applied to the absorbent core surface in a dry state from an aerosol spray employing "Freon" gas as a propellant after which the nonwoven cover is placed around the core with the ends extending beyond the ends of the core to form attachment tabs. The cover is not treated with the enzyme.

The sanitary napkin prepared as above is first weighed and is then subjected to clinical in-use testing by being worn during the second day of the menstrual cycle for a period of two hours. The used napkin is then weighed to determine quantitatively the amount of menstrual fluid absorbed during the two hour period.

Subjected to the identical clinical in-use testing and quantitative menstrual fluid absorption determination set forth in Example I or sanitary napkins prepared according to the examples following below. The results of these in-use tests are summarized in Section 1 of Table 2.

Example II

A sanitary napkin has 0.3 milligram per square centimeter of "Protease 43 Concentrate" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover remains untreated.

Example III

A sanitary napkin has 1.0 milligram per square centimeter of "NOVO" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover remains untreated.

Example IV

A sanitary napkin has 1.0 milligram per square centimeter of "Prolase 300 Z" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover remains untreated.

Example V

A sanitary napkin has 0.6 milligram per square centimeter of "Protease 43" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover also has applied thereto in the portion overlying the top of the absorbent core, 0.6 milligram per square centimeter of "Protease 43" enzyme.

Example VI

A sanitary napkin has 1.0 milligram per square centimeter of "Protease 43 Concentrate" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the top of the absorbent core, 0.9 milligram per square centimeter of "Bioprase #00379" enzyme.

Example VII

A sanitary napkin has 0.3 milligram per square centimeter of "Chymotrypsin" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the top of the absorbent core, 0.9 milligram per square centimeter of "Bacterial Protease" enzyme.

Example VIII

A sanitary napkin has 0.3 milligram per square centimeter of "NOVO" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the top of the absorbent core, 0.3 milligram per square centimeter of "EB-21" enzyme.

Example IX

A sanitary napkin has 0.3 milligram per square centimeter of "Prolase 300 Z" enzyme applied to the upper surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the top of the absorbent core, 0.6 milligram per square centimeter of "NAGARSE" enzyme.

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Example X

A sanitary napkin is prepared in which the absorbent core remains untreated with any enzyme but in which the fluid pervious cover has applied thereto in the portion overlying the top surface of the absorbent core, 0.6 milligram per square centimeter of "Protease 43 Concentrate" enzyme.

Example XI

A catamenial tampon is prepared having an absorbent, compressed, cylindrical core of tissue pulp and short rayon fibers, around which is wrapped a nonwoven porous cover. The leading one-half of the surface of the core has applied thereto 0.6 milligram of "EB-21" enzyme per square centimeter of surface area. The enzyme is applied to the absorbent core surface in a dry state from an aerosol spray employing "Freon" gas as a propellant after which the nonwoven cover is wrapped around the core. A withdrawal string is knotted around the core at its trailing end to provide a means for removing the tampon. The cover is not treated with the enzyme.

The tampon prepared as above is first weighed and is then subjected to clinical in-use testing by being worn during the second day of the menstrual cycle for a period of two hours. The used tampon is then weighed to determine quantitatively the amount of menstrual fluid absorbed during the two hour period.

Subjected to the identical clinical in-use testing and quantitative menstrual fluid absorption determination set forth in Example XI are catamenial tampons prepared according to the examples following below. The results of these in-use tests are summarized in Section 2 of Table 2.

Example XII

A catamenial tampon has 0.3 milligram per square centimeter of "Protease 43 Concentrate" enzyme applied to the leading two-thirds of the surface of the absorbent core. The fluid pervious cover remains untreated.

Example XIII

A catamenial tampon has 1.0 milligram per square centimeter of "Papain 350" enzyme applied to the leading two-thirds of the surface of the absorbent core. The fluid pervious cover remains untreated.

Example XIV

A catamenial tampon has 0.8 milligram per square centimeter of "NOVO" enzyme applied to the leading one-half of the surface of the absorbent core. The fluid pervious cover remains untreated.

Example XV

A catamenial tampon has 0.5 milligram per square centimeter of "Prolase 300 Z" enzyme applied to the leading two-thirds of the surface of the absorbent core. The fluid pervious cover remains untreated.

Example XVI

A catamenial tampon has 0.6 milligram per square centimeter of "Crystalline Porcine Trypsin" enzyme applied to the leading one-half of the surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the leading one-half of the surface of the absorbent core, 0.6 milligram per square centimeter of "Capazyme" enzyme.

Example XVII

A catamenial tampon has 1.0 milligram per square centimeter of "Rhozyme J-25" enzyme applied to the leading one-half of the surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the leading one-half of the surface of the absorbent core, 1.0 milligram per square centimeter of "Rhozyme P-11" enzyme.

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Example XVIII

A catamenial tampon has 0.9 milligram per square centimeter of "Panol" enzyme applied to the leading one-half of the surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the leading two-thirds of the surface of the absorbent core, 0.3 milligram per square centimeter of "Panol Mg-Ca" enzyme.

Example XIX

A catamenial tampon has 0.3 milligram per square centimeter of "EB-21" enzyme applied to the leading one-half of the surface of the absorbent core. The fluid pervious cover has applied thereto in the portion overlying the leading one-half of the surface of the absorbent core, 0.3 milligram per square centimeter of "EB-21" enzyme.

Example XX

A catamenial tampon is prepared in which the absorbent core remains untreated with any enzyme but in which the fluid pervious cover has applied thereto in the portion overlying the leading one-half of the surface of the absorbent core, 0.3 milligram per square centimeter of "NOVO" enzyme.

Example XXI

A catamenial tampon is prepared in which the absorbent core remains untreated with any enzyme but in which the fluid pervious cover has applied thereto in the portion overlying the leading one-half of the surface of the absorbent core, 0.6 milligram per square centimeter of "Protease 43 Concentrate" enzyme.

Example XXII

A catamenial tampon is prepared in which the absorbent core remains untreated with any enzyme but in which the fluid pervious cover has applied thereto in the portion overlying the leading one-half of the surface of the absorbent core, 1.0 milligram per square centimeter of "Rhozyme W-15" enzyme.

Example XXIII

A catamenial tampon is prepared in which the absorbent core remains untreated with any enzyme but in which the fluid pervious cover has applied thereto in the portion overlying the leading one-half of the surface of the absorbent core, 0.5 milligram per square centimeter of "Prolase 300 Z" enzyme.

The following Table 2 summarizes the results obtained from in-use tests on the above examples. The first listed standard napkin in Section 1 and standard tampon in Section 2 are the average results obtained in the tests using napkins and tampons which remain totally untreated with the enzymes of the present invention.

TABLE 2

Section 1, Sanitary Napkins		Section 2, Catamenial Tampons	
Example	Absorbed menstrual fluid in two hour period, gms. (average)	Example	Absorbed menstrual fluid in two hour period, gms. (average)
Standard Napkin	4.8	Standard Tampon	2.6
I	8.7	XI	6.5
II	6.1	XII	5.1
III	9.2	XIII	7.3
IV	8.8	XIV	5.9
V	11.1	XV	6.6
VI	11.6	XVI	7.8
VII	11.0	XVII	8.0
VIII	9.0	XVIII	7.2
IX	8.8	XIX	6.8
X	8.6	XX	5.3
		XXI	6.6
		XXII	6.7
		XXIII	6.2

From the foregoing description, accompanying drawings and examples setting forth illustrative embodiments

of the invention, it is seen that I have provided catamenial pads which are economical to make, which effectively fluidized gelatinous and mucoid constituents of menstrual fluids being absorbed by the catamenial pads and which effectively prevent obturation of the pores of catamenial pads thereby more effectively absorbing and retaining menstrual fluids and the gelatinous and mucoid constituents thereof. It is apparent that variations, modifications and changes in the foregoing illustrative embodiments and examples can be made while still remaining within the spirit and scope of the invention as defined by the appended claims.

I claim:

1. An absorbent catamenial pad comprising a relatively thick absorbent core of fibrous material and a liquid pervious fibrous cover around said core, said pad containing within the fibrous structure on at least the portion of the surface area thereof first to intercept menstrual fluids in use, an enzyme having proteolytic, mucolytic or

amylolytic activity in an amount ranging from about 0.3 mg./cm.² to about 2.0 mg./cm.².

2. An absorbent catamenial pad as defined in claim 1 wherein said enzyme is present in an amount ranging from about 0.6 mg./cm.² to about 1.2 mg./cm.².

3. An absorbent catamenial pad as defined in claim 1 wherein said enzyme is contained within the fibers on the surface of said absorbent core.

4. An absorbent catamenial pad as defined in claim 1 wherein said enzyme is contained within the fibers of said liquid pervious cover.

5. A sanitary napkin as defined in claim 1.

6. A catamenial tampon as defined in claim 1.

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