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(54) Title: FIBROUS ABSORBENT ARTICLES HAVING MALODOR COUNTERACTANT

(57) Abstract: There is provided a tampon or similar device or product in which there is disposed at least one surface active agent. A broad feature of the present invention provides a fibrous absorbent article for absorbing body fluids made up of a fibrous material defining a structure suitable for absorbing the body fluids, and disposed in or on the structure, an effective amount of at least one surface active agent, so as to absorb malodor associated with these bodily fluids.

FIBROUS ABSORBENT ARTICLES HAVING MALODOR COUNTERACTANT

BACKGROUND OF THE INVENTION

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1. Field of the Invention

The present invention relates to fibrous absorbent articles having a surface active agent with odor adsorbing properties. More particularly, the present invention relates to fibrous absorbent articles with at least one surface active agent that has the ability to adsorb onto surfaces or interfaces to alter the surfaces or interfacial free energy of the interfaces of the fibrous absorbent articles, where the interfacial free energy is defined as the force needed to oppose the pull of the molecules in the surface or interface.

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2. Description of the Prior Art

A variety of proposals have been made in the past as a way to counteract menstrual odors. Such proposals include the use of perfumes to mask the odors that emanate from the absorbent article. Other proposals include the use of substances to suppress or remove odoriferous compounds that may be generated in the presence of menstrual fluids and the like. These odoriferous compounds may be suppressed by a number of mechanisms including forming a non-odoriferous compound by chemical reaction or by absorption of the odoriferous compounds into a solid or liquid. For an absorbent to be effective in deodorizing, especially for odors from body fluids that are characterized as having very low olfactory thresholds, it is essential that the sorbent be capable of removing, in its environment, virtually all the odoriferous compounds regardless of the concentration thereof.

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In order to provide a full background for the present invention reference may be made to U.S. Patent Nos. 3,948,257; 4,795,482; 4,826,497; 5,364,380; and also Registration HI579.

5 U.S. Patent No. 3,948,257 is directed to a vulva deodorant system comprising a tampon for insertion into the vagina and a device for retaining a deodorant. The device includes a deodorant in the form of a perfume, powder or the like.

10 U.S. Patent No. 4,795,482 is directed to a process for eliminating odors and compositions for use therein. The method involves reducing the odors below olfactory detection by contact of the odor producing species with a synthetic crystalline siliceous molecular sieve material.

15 U.S. Patent No. 4,826,497 provides fibrous absorption articles having enhanced deodorizing properties by having disposed therein an effective amount of crystalline siliceous molecular sieve having pore diameters of at least about 5.5 angstroms and a relatively low capacity for adsorbed water. In addition, this patent provides for the inclusion of zeolite
20 particles having a size of less than about 20 micrometers in the deodorizing sieve. The particles are positioned between the exterior surface of the fluid permeable cover of the absorbent article and a baffle provided within the article.

25 U.S. Patent No. 5,364,380 provides an absorbent article having a first surface facing the body of a user and a second surface aligned approximately opposite to the first surface. There is also provided a liquid-impermeable baffle and a fluid-permeable cover positioned adjacent to the respective surfaces. In addition, a deodorizing mixture is positioned in the
30 article to remain dry for a substantial period of time. The mixture is an anhydrous, non-buffer blend of at least basic and pH neutral odor adsorbing particles.

Registration HI579 provides zeolites having "intermediate" SiO₂/Al₂O₃ ratios used in catamenials, diapers and the like to control odors. Such intermediate ratios are described as typically in the range from about 2 to about 10.

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It may be the case that when applied appropriately there are particular benefits and advantages to the several inventions described in the aforesaid patents. However, it will be apparent that the present invention provides a key advantage not found in prior art. What has been discovered and recognized is that the fibrous absorbent articles with the at least one surface active agent of the present invention have the capacity to adsorb odoriferous organic molecules on or in the fibrous absorbent article and in the bodily fluid in the vagina. As a result, malodor is controlled and/or eliminated.

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SUMMARY OF THE INVENTION

It is an object of the present invention to provide a fibrous absorbent catamenial article or product, such as a tampon, that can be reliably and inexpensively produced and that will efficiently adsorb odors associated with menstrual fluid.

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It is another object of the present invention to provide such a tampon having at least one surface active agent with odor adsorbing properties.

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It is yet another object of the present invention to provide such a tampon where the at least one surface active agent adsorbs onto the surface or interface to alter the surface or interfacial free energy of the interface, resulting in odor adsorption.

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It is a further object of the present invention to provide a method of incorporating the at least one surface active agent into a tampon.

The above and other objects and advantages of the present invention are achieved by a tampon or similar device or product in which there is disposed at least one surface active agent. Briefly stated, a broad feature of the present invention is a fibrous absorbent article for absorbing
5 body fluids made up of a fibrous material defining a structure suitable for absorbing the body fluids, and disposed in or on the structure, an effective amount of at least one surface active agent, so as to adsorb malodor associated with these bodily fluids.

10 Other and further objects, advantages and features of the present invention will be understood by reference to the following description.

DETAILED DESCRIPTION OF THE INVENTION

15 The present invention is directed to a fibrous absorbent article, such as a tampon or feminine pad, with at least one surface active agent disposed on or in the fibrous absorbent article. The at least one surface active agent has the property of adsorbing onto surfaces or interfaces to alter the surface or interfacial free energies of the interface. The term
20 "interface", as used herein, refers to a boundary between phases including, but not limited to, liquid-liquid phase boundaries, liquid-solid phase boundaries, liquid-gas phase boundaries, and gas-solid phase boundaries. When vaginal malodor compositions come into contact with a fibrous absorbent article, such as a tampon, the phase boundary area between the
25 malodor and fiber surface is large relative to the volume of the system. Therefore, the total mass of the system is present at the boundaries.

The behavior of the fiber system is determined to a large degree by the interfacial processes. The at least one surface active agent can play an
30 important role in the process. Surface active agents have a molecular structure with a structural group that has little attraction for the solvent phase (lyophobic) and a group that has a strong attraction for the solvent phase (lyophilic). When surface active agents are added to the surface of

fibers of a tampon, the presence of the lyophobic group causes a distortion of the solvent liquid structure, thus increasing the free energy of the system. In the presence of an aqueous solution of a surface active agent, this distortion of the malodor (water) phase by the lyophobic group, and the
5 resulting increase in the free energy of the system, results in less energy required to bring a surface active agent, rather than a water molecule, to the surface. Therefore, the at least one surface active agent concentrates on the surface of the fibrous absorbent article.

10 The presence of the lyophilic group prevents the surface active agent from being expelled from the solvent phase. As a result, the surface active agent concentrates at the surface and orients itself so that the hydrophilic group is in the aqueous phase (malodor phase) and the hydrophobic group is oriented away from the aqueous phase. The
15 malodorous components are therefore chemically bound (ionic and/or covalent) by the surface active agents onto the surface at the fiber-liquid interface.

The chemical structure of the at least one surface active agent
20 suitable for this application can vary with the nature of the fiber chemistry, malodor phase and the conditions of use. In the presence of a polar solvent phase such as vaginal malodor, ionic or highly polar groups may act as the lyophilic groups. In the presence of electrolytes or organic additives as in vaginal malodor, several surface active agents may be
25 needed to maintain surface activity at a suitable level. For surface activity (adsorption of malodor) to be effective, the at least one surface active agent molecule must have a chemical structure that is amphipathic in the malodor phase under the conditions of use.

30 Suitable surface active agents for use with the present invention include, but are not limited to, one or more surfactants, polymers, or any combinations thereof.

Suitable surfactants include, but are not limited to, one or more anionic, nonionic, cationic, amphoteric, silicone-based, polymeric, or any combinations thereof.

5 Suitable anionic surfactants that may be used in the present invention include, but are not limited to, sodium alkyl aryl ethoxy sulfate, alkylalkoxylated phosphate ester sodium salt, dioctylester of sodium sulfosuccinic acid, dioctyl sulfosuccinate, ammonium salt of polycarboxylic acid, potassium salt of complex organic phosphate ester, ammonium lauryl
10 ether sulfate, or any combinations thereof.

Suitable nonionic surfactants that may be used in the present invention include, but are not limited to, polyoxyethylene, polyoxyethylene stearic acid, polyoxyethylene 40 hydrogenated castor oil, alkanolamides, isostearyl
15 alcohol, polyoxyethylene /polyoxypropylene block copolymer, glycerol mono/dioleate, glycerol mono/distearate, ethoxylated linear alcohols (50% ethoxylated), PEG-2 stearate, polyoxyalkylated isostearyl alcohol, polyoxyethylene sorbitan monostearate, triglycerol monooleate, polysorbate 80, glyceryl monostearate, diglyceryl diisostearate,
20 polyoxyethylene 20, polyoxyethylene 20 sorbitan monooleate, silicone glycol copolymer, polyglyceryl ester, glycol distearate, ethoxylated alcohols (Cetareth-20), glycol esters (PEG 400 ditallate), or any combinations thereof.

25 Suitable cationic surfactants that may be used in the present invention include, but are not limited to, trimethyl coco quaternary ammonium chloride, distearyl dimonium chloride, benzalkonium chloride, benzethonium chloride, or any combinations thereof.

30 Suitable amphoteric surfactants that may be used in the present invention include, but are not limited to, coconut-based (imidazoline, dicarboxylate, sodium salt), coco amido betaine, betaine derivatives (oleyl betaine), octyl dipropionate, cocamphoglycinate, or any combinations

thereof.

Suitable silicone-based surfactants that may be used in the present invention include, but are not limited to, cetyl dimethicone copolyol,
5 dialkoxy dimethyl polysiloxane, polysiloxane polyalkyl copolymers, or any combinations thereof.

Suitable polymer that may be used in the present invention includes,
but is not limited to, acrylates/C10-30 alkyl acrylate crosspolymer.
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In order to achieve the odor adsorption properties of the present invention, the at least one surface active agent is present in an amount about 0.001 percentage by weight (wt.%) to about 30 wt.% and preferably about 0.01 wt.% to about 5 wt.%, based on the total weight of the fibrous
15 absorbent article.

The following example demonstrates the effectiveness of the use of a surface active agent on a tampon to reduce and/or eliminate malodor.

20 A study was conducted to identify and rate the aroma attributes and intensities of malodor treated non-deodorant tampons with varying levels/types of malodor adsorbing/neutralizing treatments, including one with a surface active agent according to the present invention.

25 Samples were prepared using unscented tampons according to a detailed protocol. Each sample included a 15% malodor applied to the unscented tampon. The samples prepared are indicated below in Table 1. The samples in Table 1 were prepared and tested on three separate occasions.

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Table 1. Samples

Sample A - Non-deodorant tampon + 15% malodor solution

Sample B - Non-deodorant tampon + 15% malodor solution + zeolite (0.7 wt.% to 2.63 wt.%)

5 Sample C - Non-deodorant tampon + 15% malodor solution + glycerin (0.92 wt.% to 3.61 wt.%)

Sample D - Non-deodorant tampon + 15% malodor solution + glycerin (0.92 wt.% to 1.81 wt.%) + polyoxyethylene (20) (0.64 wt.% to 1.25 wt.%)

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Evaluation of the samples was performed in a well-ventilated room having an exhaust fan available. Five objective sensory experts, trained experienced, and calibrated in aroma analysis, evaluated the samples on the date of receipt. Each panelist received a complete set of samples with the control and non-deodorant products. All panelists evaluated a sample at the same time, and consensus results of the characteristics and intensities were recorded. Panelists waited at least 30 minutes between evaluations and were allowed to smell a neutral substrate (paper napkin or back of arm) between and within samples as needed to prevent acclimating to the malodor or fragrance. For each session, one sample was randomly repeated as a check of intensity results. The repeated sample was generally one for which variable results were detected within jar from a single sample treatment.

25 The intensity of the sensory characteristics were rated on a 15 point intensity scale with 0 = none and 15 = very strong. Data is reported as consensus data. It is noted that panelists are able to see small differences and can often detect aroma differences as small as 0.2 units on the 15-point scale used. Panelists commonly detect differences of 0.5 units.

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Table 2 provides mean results over three replications. When reviewing Table 2, it is noted that for attributes having a range in intensity

across jars within a sample, the highest values were used to calculate means.

Table 2. Non-Deodorant Samples – Mean Profiles

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	Sample A MEAN	Sample B MEAN	Sample C MEAN	Sample D MEAN
Malodor Intensity	6.0	5.9	5.3	4.9
Isovaleric	1.7	2.0	2.0	1.8
Ammonia	2.4	2.0	1.8	2.0
Degraded Protein	2.5	2.5	2.3	1.8
Ferric	1.0	1.0	1.0	0.9
Popcorn/Paper	0.0	0.2	0.0	0.3
Sulfite/Paper	0.8	0.0	0.0	0.3

As is evident from Table 2, Sample D, with the surface active agent according to the present invention, exhibited the lowest overall malodor intensity of the samples tested.

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The at least one surface active agents may be incorporated in a fibrous absorbent article in any of the following methods, including but not limited to, application during fiber processing, post-processing fiber surface treatment, deposited on the inside of the article, applied to the exterior of the article, included in a coverstock material, included in the removal string or other removal device, included as part of the applicator, encapsulated and applied in above-referenced ways, or any combinations thereof.

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Application methods may include but are not limited to spraying of surfactant in a patterned or random arrangement, deposited in droplets, or any combinations thereof.

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The present invention having been thus been described with particular reference to the preferred forms thereof, it will be obvious that

various changes and modifications may be made therein without departing from the spirit and scope of the present invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A fibrous absorbent article for absorbing body fluids, the fibrous absorbent article having at least one surface active agent.
5
2. The fibrous absorbent article of claim 1, wherein said at least one surface active agent is selected from the group consisting of one or more surfactants, polymers, and any combinations thereof.
- 10 3. The fibrous absorbent article of claim 2, wherein said one or more surfactants are selected from the group consisting of one or more anionic, nonionic, cationic, amphoteric, silicon-based, polymeric, and any combinations thereof.
- 15 4. The fibrous absorbent article of claim 2, wherein said one or more surfactants is one or more anionic surfactants selected from the group consisting of sodium alkyl aryl ethoxy sulfate, alkylalkoxylated phosphate ester sodium salt, dioctylester of sodium sulfosuccinic acid, dioctyl sulfosuccinate, ammonium salt of polycarboxylic acid, potassium
20 salt of complex organic phosphate ester, ammonium lauryl ether sulfate, and any combinations thereof.
- 25 5. The fibrous absorbent article of claim 2, wherein said one or more surfactants are one or more nonionic surfactants selected from the group consisting of polyoxyethylene, polyoxyethylene stearic acid, polyoxyethylene 40 hydrogenated castor oil, alkanolamide, isostearyl alcohol, polyoxyethylene/polyoxypropylene block copolymer, glycerol mono/dioleate, glycerol mono/distearate, ethoxylated linear alcohols, PEG-
30 monostearate, triglycerol monooleate, polysorbate 80, glyceryl monostearate, diglyceryl diisostearate, polyoxyethylene 20, polyoxyethylene 20 sorbitan monooleate, silicone glycol copolymer,

polyglyceryl ester, glycol distearate, ethoxylated alcohol, glycol ester, and any combinations thereof.

5 6. The fibrous absorbent article of claim 2, wherein said one or more surfactants is one or more cationic surfactants selected from the group consisting of trimethyl coco quaternary ammonium chloride, distearyl dimonium chloride, benzalkonium chloride, benzethonium chloride, and any combinations thereof.

10 7. The fibrous absorbent article of claim 2, wherein said one or more surfactants is one or more amphoteric surfactants selected from the group consisting of coconut-based imidazoline, coconut-based dicarboxylate, coconut-based sodium salt, cocoamidobetaine, betaine derivatives, oleyl betaine, octyl dipropionate, cocamphoglycinate, and any combinations thereof.

15 8. The fibrous absorbent article of claim 2, wherein said one or more surfactants is one or more silicone-based surfactants selected from the group consisting of cetyl dimethicone copolyol, dialkoxo dimethyl polysiloxane, polysiloxane polyalkyl copolymer, and any combinations thereof.

20 9. The fibrous absorbent article of claim 2, wherein said one or more polymers is a acrylates/C10-30 alkyl acrylate crosspolymer.

25 10. The fibrous absorbent article of claim 1, wherein said at least one surface active agent is present in the fibrous absorbent article in an amount about 0.001 wt.% to about 30 wt.%.

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11. A method for counteracting malodor in a bodily fluid comprising the steps of:

providing a fibrous absorbent article; and

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disposing at least one surface active agent on or in said fibrous absorbent article,

wherein said at least one surface active agent adsorbs onto a surface or interface of said fibrous absorbent article, altering an interfacial free energy at the interface or surface of said fibrous absorbent article, and wherein the malodor has one or more malodor molecules that are chemically bound by said at least one surface active agent onto the surface of the fibrous absorbent article.

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12. The method of claim 11, wherein said at least one surface active agent is selected from the group consisting of one or more surfactants, polymers, and any combinations thereof.

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13. The method of claim 12, wherein said one or more surfactants are selected from the group consisting of one or more anionic, nonionic, cationic, amphoteric, silicon-based, polymeric, and any combinations thereof.

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14. The method of claim 12, wherein said one or more surfactants is one or more anionic surfactants selected from the group consisting of sodium alkyl aryl ethoxy sulfate, alkylalkoxylated phosphate ester sodium salt, dioctylester of sodium sulfosuccinic acid, dioctyl sulfosuccinate, ammonium salt of polycarboxylic acid, potassium salt of complex organic phosphate ester, ammonium lauryl ether sulfate, and any combinations thereof.

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15. The method of claim 12, wherein said one or more surfactants are one or more nonionic surfactants selected from the group consisting of polyoxyethylene, polyoxyethylene stearic acid, polyoxyethylene 40 hydrogenated castor oil, alkanolamide, isostearyl alcohol, polyoxyethylene/polyoxypropylene block copolymer, glycerol mono/dioleate, glycerol mono/distearate, ethoxylated linear alcohols, PEG-2 stearate, polyoxyalkylated isostearyl alcohol, polyoxyethylene sorbitan monostearate, triglycerol monooleate, polysorbate 80, glyceryl monostearate, diglyceryl diisostearate, polyoxyethylene 20, polyoxyethylene 20 sorbitan monooleate, silicone glycol copolymer, polyglyceryl ester, glycol distearate, ethoxylated alcohol, glycol ester, and any combinations thereof.

16. The method of claim 12, wherein said one or more surfactants is one or more cationic surfactants selected from the group consisting of trimethyl coco quaternary ammonium chloride, distearyl dimonium chloride, benzalkonium chloride, benzethonium chloride, and any combinations thereof.

17. The method of claim 12, wherein said one or more surfactants is one or more amphoteric surfactants selected from the group consisting of coconut-based imidazoline, coconut-based dicarboxylate, coconut-based sodium salt, cocoamidobetaine, betaine derivatives, oleyl betaine, octyl dipropionate, cocamphoglycinate, and any combinations thereof.

18. The method of claim 12, wherein said one or more surfactants is one or more silicone-based surfactants selected from the group consisting of cetyl dimethicone copolyol, dialkoxy dimethyl polysiloxane, polysiloxane polyalkyl copolymer, and any combinations thereof.

19. The method of claim 12, wherein said one or more polymers is an acrylates/C10-30 alkyl acrylate crosspolymer.

20. The method of claim 1, wherein said at least one surface
5 active agent is present in said fibrous absorbent article in an amount about 0.001 wt.% to about 30 wt.%.