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(71) Applicant (for all designated States except US): SCA
Hygiene Products AB [SE/SE]; S-405 03 Göteborg (SE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): FORSGREN
BRUSK, Ulla [SE/SE]; Plommonvägen 35, S-435 43
Pixbo (SE). STRIDFELDT, Chatrine [SE/SE]; Bäck-
slingan 14, S-436 58 Hovås (SE). MALMGREN, Kent
[SE/SE]; Harmonigatan 11C, S-854 63 Sundsvall (SE).

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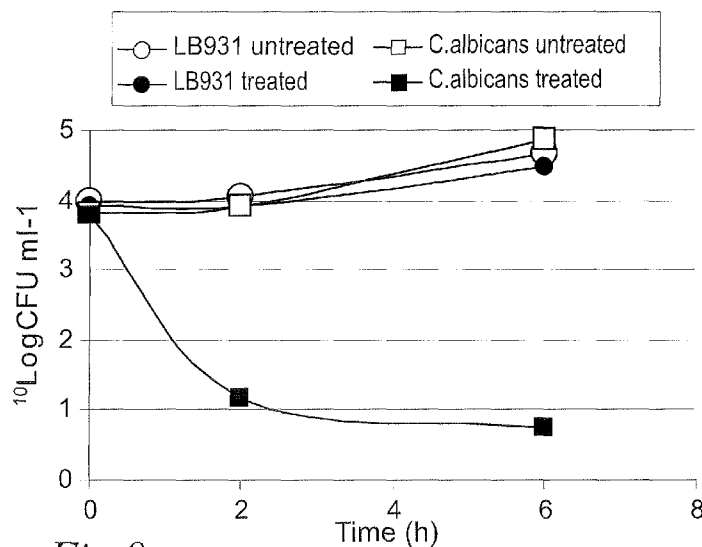


Fig. 8

(57) Abstract: A sanitary article such as a sanitary napkin, panty liner, diaper, pant diaper, adult incontinence guard, hygiene tissue, wherein the article comprises oxidized lipids and probiotic bacteria. Preferably the lipids are oxidized under controlled conditions to have a peroxide number of at least 20 meq/kg. The lipids are for example triglycerides of fatty acids.

SANITARY ARTICLE WITH PROBIOTIC EFFECT

TECHNICAL FIELD

The present invention relates to a sanitary article, such as a sanitary napkin, panty liner, incontinence protector, diaper, tampon, wet wipe, tissue or the like, wherein the article
5 provide an enhanced effect against *Candida albicans* and other unwanted microorganisms.

BACKGROUND OF THE INVENTION

The urogenital area harbors a complex microbial ecosystem comprising more than 50
10 different bacterial species (Hill et al., Scand. J. Urol. Nephrol. 1984;86 (suppl.) 23-29).
The dominating species for fertile women in this area are lactic acid producing bacteria belonging to the genus *Lactobacillus*. These lactic acid producing members are important for retaining a healthy microbial flora in these areas, and act as probiotic bacteria with an antagonistic effect against pathogenic microbial species. Lactic acid producing bacteria
15 inhibit growth and colonization by other microorganisms by occupying suitable niches for colonization, by forming biofilms and competing for available nutrients, thereby excluding colonization by harmful microorganisms. Also, the production of hydrogen peroxide, specific inhibiting substances, such as bacteriocines, and organic acids (including lactic acid and acetic acid) that lower the pH, inhibit the growth and colonization by other
20 microorganisms.

The microbial ecosystem of a healthy individual can be disturbed by the use of antibiotics, during hormonal changes, such as during pregnancy or use of contraceptives with estrogen, during menstruation, after menopause, in people suffering from diabetes etc.
25 Also, microorganisms may spread from the anus to the urogenital area, this results in a disturbance of the normal microbial flora and leaves the individual susceptible to microbial infections such as vaginitis, candida infections, urinary tract infections and skin infections. Microorganisms commonly associated with these kinds of infections belong to the genera *Escherichia*, *Enterococcus*, *Pseudomonas*, *Proteus*, *Klebsiella*, *Streptococcus*,
30 *Staphylococcus*, *Gardnerella* and *Candida*. Women are at particular risk due to their shorter distance between the anus and the urogenital tract; specially at risk are young women before entering puberty, who not yet have a well developed microflora in the urogenital area, and post-menopausal women, who in most cases no longer have a protective flora.

- Similarly to the urogenital area, the skin is colonized by an array of organisms, which forms its normal flora. The numbers and identity of the organisms vary between different skin sites. This, together with the skin's structural barrier, provides the host with an excellent defense against invading microbes. The number of bacteria on the skin varies
- 5 from a few hundred per cm² on the arid surfaces of the forearm and back, to tens of thousands per cm² on the moist areas such as the axilla and groin. This normal flora plays an important role in preventing foreign organisms from colonizing the skin, but it too needs to be kept in check, in order to avoid skin infections.
- 10 *Staphylococcus aureus* is the most common cause of minor skin infections, such as boils or abscesses, as well as more serious post-operative wound infection. Treatment involves drainage and this is usually sufficient for minor lesions, but antibiotics may be given in addition when the infection is severe and the patient has fever.
- 15 Toxic shock syndrome is a systemic infection caused by *S. aureus* strains which produce toxic shock syndrome toxin. The disease came to prominence through its association with tampon use by healthy women, but it is not confined to women and can occur as a result of *S. aureus* infection at non-genital sites.
- 20 Other common skin infections are caused by *Streptococcus pyogenes* (group A streptococci). The organisms are acquired through contact with other people with infected skin lesions and may first colonize and multiply on normal skin prior to invasion through minor breaks of the epithelium and the development of lesions.
- 25 Treatment with penicillin or erythromycin may be necessary to combat the infection.

C.albicans is a yeast organism always present in humans but are usually prevented from overgrowth by the indigenous microbial flora. *C.albicans* likes skin sites which are moist and warm and also rapidly colonizes damaged skin. Hence, the relative dryness of most

30 areas of skin prevents the growth of *C.albicans*, which therefore are found in low numbers on healthy skin. *C.albicans* also colonizes the oral and vaginal mucosa and over-growth may result in disease in these sites. *C.albicans* is associated with diaper dermatitis. A study has shown that *C. albicans* induced lesions are remarkably influenced by pH, a lower skin pH giving less lesions (B. Runeman, Acta Derm Venereol 2000 ; 80: 421-424).

Dermatophytosis, or athlete's foot, is a group of mycosis infections of the skin caused by the parasitic fungi *dermophytes*. Dermatophytosis causes scaling, flaking, and itching of affected areas. Dermatophytosis likes warm and moist environments and is typically transmitted in moist areas where people walk barefoot, such as showers or bathhouses.

5

One way to reduce the problems with the kind of infections described above is to have a good personal hygiene. However, excessive use of cleaning agents not only decreases the amount of harmful microbes, but can harm the beneficial microbial flora, again render it susceptible for pathogenic species to colonize and cause infections. Alternatively,

10 administration of lactic acid producing bacteria to the urogenital area and the skin, in order to out-compete pathogenic species and facilitate reestablishment and maintenance of a beneficial microbial flora in these areas, has been found to be a successful means to treat and prevent microbial infections

15 It has been suggested that lactic acid producing bacteria can be delivered via absorbent products, such as diapers, sanitary napkin, incontinence guards, panty liners and tampons, as described in, for example, WO 92/13577, WO 97/02846, WO 99/17813, WO 99/45099 and WO 00/35502.

20 Other ways of delivering the lactic acid producing bacteria have also been suggested, such as a hygiene tissue that allows both cleaning and caring of the skin and urogenital area and delivery of probiotic lactic acid producing bacteria, for example, WO 04/060416.

One way to apply lactic acid producing bacteria in sanitary articles is to disperse the
25 bacteria in a hydrophobic carrier in order to protect them from moisture and thus a too early activation as e.g. described in EP 1 3 22 246. The hydrophobic carrier may be fatty acids according to EP 1 3 22 246.

GB 1 282 889 discloses a deodorant composition comprising at least one calcium,
30 aluminium, magnesium or zinc salt of an unsaturated aliphatic hydroxycarboxylic acid having at least 17 carbons. It is said that the zinc salt may show a fungistatic activity. It is further told that these metal salts can be combined with saturated aliphatic hydroxycarboxylic acids and unsaturated aliphatic hydroxycarboxylic acids. The saturated hydroxycarboxylic acids may either be naturally saturated or derived from oxidation
35 products of unsaturated fatty acids, such as oleic acid, ricinoleic acid, linoleic acid and

linolenic acid. These unsaturated fatty acids upon mild oxidation lead to corresponding pure hydroxycarboxylic acids. Pure hydroxycarboxylic acids have very low oxidizing ability on other substances and a peroxide value close to 0 meq/kg. Other functional groups than hydroxyl functions are needed to give a fatty acid a real oxidizing ability. Examples of
5 such functional groups are hydroperoxid and ozonide functions. However, when discussing the saturated aliphatic hydroxycarboxylic acids and unsaturated aliphatic hydroxycarboxylic acids the only effect discussed is their deodorising effect.

In view of the prior art there is still a need for sanitary articles with an improved probiotic
10 effect.

SUMMARY OF THE INVENTION

The present invention relates to sanitary articles, such as sanitary napkins, panty liners, incontinence protectors, diapers, hygiene tissues, wherein to the article probiotic bacteria
15 and at least one oxidized lipid has been added in order to inhibit the growth of unwanted microorganisms and give an improved probiotic effect.

It has surprisingly been found that oxidized lipids have a selective effect against *Candida albicans* and other unwanted microorganisms, and that a combined use of oxidized lipids
20 and probiotic bacteria gives a very effective inhibition of *Candida albicans* or other unwanted microorganisms. The oxidized lipids effectively suppress the proliferation of *Candida albicans* and other unwanted microorganisms such as *E. faecalis*, *E. coli* and *P. mirabilis* while the probiotic beneficial bacteria remains essentially unaffected. The combined use of the probiotic bacteria and the oxidized lipid will thus result in a
25 decreased number of unwanted microorganisms and further also an increased number of established probiotic beneficial bacteria in the microflora of the user of the sanitary article.

In one aspect of the invention the lipids have been oxidized under controlled conditions. Preferably the oxidized lipids have a peroxide value as measured by AOCS Official
30 Method Cd 8-53 of at least 20, preferably at least 30 and more preferably at least 40 meq/kg.

In a further aspect said oxidized lipids are oxidized by treatment with ozone.

35 In one aspect the lipids are fatty acids or derivatives thereof. In a further aspect, the fatty

acid derivatives are esters of fatty acids, especially triglycerides.

In a still further aspect at least part of the fatty acids and/or fatty acid derivatives are unsaturated.

5

In one aspect of the invention said probiotic bacteria are lactic acid producing bacteria.

In a further aspect said sanitary article comprises 10^5 to 10^{11} CFU, preferably 10^8 to 10^{10} CFU of probiotic bacteria.

10

According to one aspect of the invention the sanitary articles is an absorbent article such as a sanitary napkin, a panty liner, an incontinence protectors, a diaper or a tampon, wherein said absorbent article comprises an absorbent core.

15 In a further aspect said absorbent core comprises hydrophilic fibers treated with said oxidized lipids. In a still further aspect said hydrophilic fibers are cellulose fibers.

In one aspect of the invention it has been added at least 0.05% by weight of the oxidized lipids to said absorbent core, calculated on the total weight of the hydrophilic fibers

20 contained in the absorbent core. In a still further aspect it has been added between 0.05 and 20% by weight, preferably between 0.2 and 15% by weight, more preferably between 0.5 and 10% by weight and most preferably between 1 and 5% by weight of the oxidized lipids to said absorbent core, calculated on the total weight of the hydrophilic fibers contained in the absorbent core.

25

In one aspect of the invention the absorbent article further comprises a fluid impervious backsheet, a liquid-pervious topsheet and/or one or more additional functional layers selected from: liquid receiving layers, liquid distribution layers.

30 In one aspect of the invention at least one oxidized lipid has been added to the topsheet and/or to at least one of said additional functional layers. In a further aspect, at least 0.05% by weight of the oxidized lipids has been added to said topsheet or additional functional layer, calculated on the total weight of said topsheet and/or additional functional layer.

In a still further aspect of the invention, between 0.05 and 20% by weight, preferably between 0.2 and 15% by weight, more preferably between 0.5 and 10% by weight and most preferably between 1 and 5% by weight of the oxidized lipids has been added to said topsheet and/or additional functional layer, calculated on the total weight of the
5 topsheet and/or additional functional layer.

In one further aspect of the invention probiotic bacteria have been added to the topsheet.

In one aspect of the invention said sanitary articles is a hygiene tissue, such as a wet
10 wipe, dry wipe, wash cloth, patch, towelette or napkin. In a further aspect said hygiene tissue contains between 0.001 and 15 g/g, preferably between 0.01 and 8 g/g, more preferably 0.05 g/g and 4 g/g and most preferably between 0.1 and 3 g/g of added oxidized lipids calculated on the total weight of the hygiene tissue.

15

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic plan view of an absorbent article in the form of a sanitary napkin or incontinence guard.

Fig. 2 is a cross section according to the line II-II in Fig. 1.

20 Fig. 3 is a schematic plan view of a hygiene tissue.

Fig. 4 shows the survival of LB931 in synthetic urine added to absorbent cores with different additions of ozonized sunflower oil.

Fig. 5 shows the survival of LB87b in synthetic urine added to absorbent cores with different additions of ozonized sunflower oil.

25 Fig. 6 shows the survival of Ess1 in synthetic urine added to absorbent cores with different additions of ozonized sunflower oil.

Fig. 7 shows the survival of LB931 and *Candida albicans* in synthetic urine added to treated and untreated absorbent cores.

Fig. 8 shows the survival of LB931 and *C.albicans* 702 in synthetic urine added to
30 untreated absorbent cores and absorbent cores treated with 3 % ozonized olive oil.

Fig. 9 shows the survival of LB87b and *C.albicans* 702 in synthetic urine added to untreated absorbent cores and absorbent cores treated with 3 % ozonized olive oil.

35

DEFINITIONS

The term "sanitary article" refers to products that are placed against the skin of the wearer to absorb and contain body exudates, like urine, faeces and menstrual fluid, and also to products that are used for cleaning and caring of the skin and the urogenital area and that
5 also can be used to deliver probiotic bacteria and oxidized lipids to these areas. The invention mainly refers to disposable sanitary articles, which means articles that are not intended to be laundered or otherwise restored or reused as a sanitary article after use. Examples of disposable sanitary articles include wet wipes, dry wipes, feminine hygiene products such as sanitary napkins, panty liners, sanitary panties and tampons; diapers
10 and pant diapers for infants and incontinent adults; incontinence pads; diaper inserts and the like.

The term "absorbent article" refers to products that are placed against the skin of the wearer to absorb and contain body exudates, like urine, faeces and menstrual fluid. The
15 invention mainly refers to disposable absorbent articles, which means articles that are not intended to be laundered or otherwise restored or reused as an absorbent article after use. Examples of disposable absorbent articles include feminine hygiene products such as sanitary napkins, panty liners and sanitary panties; diapers and pant diapers for infants and incontinent adults; incontinence pads; diaper inserts and the like.

20

By "hygiene tissue" is meant any device for wiping, cleaning and caring of the skin and the urogenital area which also can be used to deliver probiotic bacteria and oxidized lipids to these areas, for instance a wet wipe, dry wipe, washcloth, patch, towelette, napkin, and the like.

25

The term "lipid" denotes all fat-soluble (lipophilic), naturally-occurring substances, such as fats, oils, waxes, cholesterol, steroids, monoglycerides, diglycerides, triglycerides, phospholipids, and others.

30 By "oxidized lipids" is meant that the lipids have undergone an oxidation process wherein oxygen has been introduced in the lipid molecular structure. The oxidation agent is any agent, which leads to oxidation of the lipid structure, e.g. oxygen gas, ozone or peroxides.

By "oxidized under controlled conditions" is meant that the substrate, i.e. the lipid has
35 been oxidized to a degree wherein further oxidation caused by autoxidation from contact

with air is substantially prevented. Preferably the lipids have been oxidized so that they have a peroxide value as measured by AOCS Official Method Cd 8-53 of at least 20 meq/kg.

- 5 By "probiotic bacteria" is meant live microorganisms that confer a health benefit when administered in adequate amounts to a host.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 and 2 show an embodiment of an absorbent article in the form of a sanitary napkin
10 or an incontinence guard 1 intended to be worn as an insert in a pair of pants. The article 1 typically comprises a liquid permeable topsheet 2, a liquid impermeable backsheet 3 and an absorbent core 4 enclosed therebetween. The article has a longitudinal direction, y, and a transverse direction, x. It has a pair of longitudinal side edges 6 and 7 and a pair of transverse edges 8 and 9.

15

The liquid permeable topsheet 2 can be composed of a nonwoven material, e.g. spunbonded, meltblown, carded, hydroentangled, wetlaid etc. Suitable nonwoven materials can be composed of natural fibers, such as woodpulp or cotton fibres, manmade fibres, such as polyester, polyethylene, polypropylene, viscose etc. or from a mixture of
20 natural and manmade fibres. The topsheet material may further be composed of tow fibres, which may be bonded to each other in a bonding pattern, as e.g. disclosed in EP-A-1 035 818. Further examples of topsheet materials are porous foams, apertured plastic films etc. The materials suited as topsheet materials should be soft and non-irritating to the skin and be readily penetrated by body fluid, such as urine or menstrual fluid.

25

The liquid impermeable backsheet 3 may consist of a thin plastic film, e.g. a polyethylene or polypropylene film, a nonwoven material coated with a liquid impervious material, a hydrophobic nonwoven material, which resists liquid penetration or laminates of plastic films and nonwoven materials. The backsheet material may be breathable so as to allow
30 vapour to escape from the absorbent core, while still preventing liquids from passing through the backsheet material.

The topsheet 2 and the backsheet material 3 have a somewhat greater extension in the plane than the absorbent core 4 and extend outside the edges thereof. The layers 2 and 3
35 are connected to each other within the projecting portions 5 thereof, e.g. by gluing or

welding by heat or ultrasonic. The topsheet and/or the backsheet may further be attached to the absorbent core by any method known in the art, such as adhesive or welding by heat or ultrasonic etc. The absorbent core may also be unattached to the topsheet and/or the backsheet.

5

A fastening means in the form of a region 10 of an adhesive is provided on the side of the backsheet facing away from the wearer in use. The adhesive may releasably attach to the undergarment of the wearer. A release paper 11 protects the adhesive region before use. The adhesive region 10 may have any suitable configuration, such as elongate or

10 transverse strips, dots, full-coated areas etc.

In other embodiments of absorbent articles according to the invention other types of fasteners, like friction fasteners, tape tabs or mechanical fasteners like hook-and-loop fasteners etc may be used to fasten the articles to the underwear or around the waist of
15 the wearer. Some absorbent articles are in the form of pants and therefore do not need special fastening means. In other cases the absorbent article is worn in special elastic pants without the need for additional fasteners.

The absorbent core 4 can be of any conventional kind. Examples of commonly occurring
20 absorbent materials are cellulosic fluff pulp, tissue layers, highly absorbent polymers (so called superabsorbents), absorbent foam materials, absorbent nonwoven materials or the like. It is common to combine cellulosic fluff pulp with superabsorbents in an absorbent core. It is also common to have absorbent bodies comprising layers of different material with different properties with respect to liquid acquisition capacity, liquid distribution
25 capacity and storage capacity. This is well-known to the person skilled in the art and does therefore not have to be described in detail. The thin absorbent bodies, which are common in today's absorbent articles, often comprise a compressed mixed or layered structure of cellulosic fluff pulp and superabsorbent material. The size and absorbent capacity of the absorbent core may be varied to be suited for different uses such as
30 sanitary napkins, pantliners, adult incontinence pads and diapers, baby diapers, pant diapers, etc.

It is understood that the absorbent article described above and shown in the drawings only represents one non-limiting example and that the present invention is not limited
35 thereto, but can be used in any type of absorbent articles as defined above.

Fig. 3 shows an embodiment of a hygiene tissue. The hygiene tissue 12 provided can be composed of a matrix comprising any natural or synthetic fiber, such as rayon, cellulose, regenerated cellulose, polyester, polyolefine fibers, textile and the like, or foam,
5 nonwoven, felt or batting, or combinations thereof.

The object of the present invention is to provide sanitary articles, such as sanitary napkins, panty-liners, diapers, incontinence guards, hygiene tissues etc. suitable for absorbing bodily fluids exudates and/or cleaning and caring of the skin and the urogenital
10 area and simultaneously release probiotic bacteria and an oxidized lipid that is to be transferred to the skin, or alternatively, in order to inhibit the growth of unwanted microorganisms in the sanitary article itself during use of the article.

It has surprisingly been found that oxidized lipids have a selective effect against *Candida*
15 *albicans* and other unwanted microorganisms, and that a combined use of oxidized lipids and probiotic bacteria gives a very effective inhibition of *Candida albicans* or other unwanted microorganisms. The oxidized lipids effectively suppress the proliferation of *Candida albicans* and other unwanted microorganisms such as *E. faecalis*, *E. coli* and *P. mirabilis* while the probiotic beneficial bacteria remains essentially unaffected. The
20 combined use of the probiotic bacteria and the oxidized lipid will thus result in a decreased number of unwanted microorganisms and further also an increased number of established probiotic beneficial bacteria in the microflora of the user of the sanitary article.

The probiotic bacteria which are suitable for use in the present invention produce acid and
25 are non-pathogenic. There are many suitable bacteria identified herein below, although the invention is not limited to currently known bacterial species and strains as long as the above function and the objectives of the bacteria are fulfilled.

An important characteristic of these bacteria is their capability to produce acid, said acid
30 increases the acidity of the skin mucosa which helps in preventing the growth, colonization and survival of undesired fungi and bacteria. Thus, by the mechanism of lactic acid production, these probiotic bacteria inhibit the growth of competing and harmful bacteria and fungi. Further important characteristic of said bacteria is their ability to produce hydrogen peroxide and other microbe inhibiting substances and also their ability

to adhere to cell surfaces and thereby prevent adhesion of other harmful bacteria to these surfaces.

Typical lactic acid-producing bacteria useful in a microbe-inhibiting composition of this invention are all members of the *Lactobacillus*, *Lactococcus* or *Pediococcus*, which are efficient acid producers, and also including non-pathogenic members of the *Bacillus* genus, all members of the *Bifidobacterium* genus, and *Pseudomonas limbergii*, although certain species are especially preferred as described below.

Preferred members of the *Lactobacillus* genus include *Lactobacillus acidophilus*, *Lactobacillus brevis*, *Lactobacillus bulgaricus*, *Lactobacillus casei*, *Lactobacillus cereale*, *Lactobacillus delbrukeii*, *Lactobacillus fermentum*, *Lactobacillus gasei*, *Lactobacillus jensenii*, *Lactobacillus plantarum*, *Lactobacillus rhamnosus*, *Lactobacillus salivarius*, *Lactobacillus thermophilus*, *Lactobacillus paracasei* sp. *paracasei*, *Lactobacillus crispatus*, *Lactobacillus helveticus*, *Lactobacillus lactis*, and the like.

Particularly preferred are *Lactobacillus fermentum* Ess-1 and *Lactobacillus plantarum* LB 931. Ess-1 has previously been found valuable for preventing and/or treating candida infections as it inhibits growth of *Candida albicans* and several other harmful microorganisms, as disclosed in WO 2008060198. LB 931 has shown to be particularly effective for preventing and/or treating other urogenital infections, as disclosed in e.g. EP1060240.

It should be noted that although in the examples below only three *Lactobacilli* species have been used, these bacteria should only be seen as a model for lactic acid producing species of probiotic bacteria useful in the practice of the present invention. Therefore the below examples should not be seen as limiting for the present invention. It is intended that any acid producing species of probiotic bacteria may be used in the composition.

A sanitary article of the present invention typically comprises lactic acid producing bacteria in amounts of about 10^5 - 10^{11} CFU (colony forming units) of viable probiotic acid-producing bacteria per article. The bacteria may be in the form of cells or spores which are provided in a suspension which is applied to the sanitary article which is thereafter dried. The bacteria may also be freeze dried and dispersed in a hydrophobic carrier, in

order to protect the bacteria from ambient moisture, before being added to the sanitary article.

Preferably, the sanitary article will comprise about 10^8 - 10^{10} CFU per sanitary article, although these amounts may vary depending on the specific application, product formulation and intended use.

It has according to the invention been shown that oxidized lipids are very effective in reducing *Candida albicans* and other unwanted microorganisms. Natural animal-derived or plant-derived lipids are very often mixtures of mono-, di- and triglycerides and free fatty acids. The lipids can be purified, hydrated, refined, modified and used individually or in different mixtures. Examples of suitable lipids which originate from animals can be found in bees waxes, emu oil, lactis lipida, lanolin, shark's liver oil, lard, whale oil, butter fat and tallow. Examples of suitable lipids which originate from plants can be found in apricot kernel oil, ground nut oil, avocado oil/wax, blackcurrant seed oil, borage seed oil, Brazil nut oil, castor oil, cacao butter, cocoa butter, coconut butter, coconut oil, maize oil, cotton seed oil, rose hip seed oil, evening primrose oil, grape seed oil, linseed oil, mango seed oil, rose oil, olive oil, orange wax, palm oil, ground nut oil, rice wax, sesame seed oil, shea butter, soybean oil, sunflower oil, sunflower seed wax, peanut oil, sesame oil, safflower oil, theobroma oil, tobacco seed oil, poppyseed oil, teased oil, kapok oil, rice bran oil, sorghum oil, crambe oil, linseed oil, perilla oil, hempseed oil, tung oil, oiticica oil, palm kern oil, sweet almond oil and wheat germ oil. Further examples of lipids are phospholipids and waxy oils, which contain esters of mono-alcohols, for example jojoba oil and seed coat wax.

25

Triglycerides are commonly occurring in many natural fats and oils. Most of the naturally occurring triglycerides contain a mixture of saturated and unsaturated fatty acids, while the proportion of saturated and unsaturated fatty acids varies between the different oils. This proportion can be given as the quotient: unsaturated/saturated. The unsaturated fatty acids may either be monounsaturated or polyunsaturated. The most commonly occurring fatty acids in triglycerides are palmitic acid, a saturated fatty acid, oleic acid, a monounsaturated fatty acid, linoleic and linolenic acids, which are polyunsaturated fatty acids.

30

The composition of some common natural oils are given in Table 1 below, which is taken from Bailey's Industrial Oil and Fat products, vol.1, editor: Daniel Swern, John Wiley & Sons Inc., New York, 1979.

5 **Table 1**

Vegetable oil	Saturated fatty acids (weight-%)	Unsaturated fatty acids (weight-%)
Olive oil	9.3-18.8	81.1-89.0
Sunflower oil	8.7-14.2	85-91
Rapeseed oil	6.2-9.5	90.5-93.8
Maize oil	12-18	82-88
Cocoa butter	59.8	40.2

Such oils and fats normally contain antioxidants, either naturally occurring or added by a supplier, so that autoxidation caused by contact with air is substantially prevented or delayed.

10

The lipids used in the present invention are oxidized by an oxidizing agent. Examples of useful oxidizing agents are: ozone, peroxides, oxygen gas, peroxy acids and nitrogen dioxide. For lipids containing antioxidants more powerful oxidizing agents like ozone and peroxides are required, but for lipids without any significant amounts of antioxidants,

15 oxygen or air, i.e. autoxidation under a sufficient time period, may be sufficient.

The reactivity of different lipids is dependant on the number of double bonds, i.e. the degree of unsaturation. Saturated lipids oxidize very slowly while lipids with a high degree of unsaturation oxidize more rapidly. The relative rates of autoxidation at a temperature of

20 100°C of some fatty acids (not treated with antioxidants) are found in Table 2 below and are taken from the same reference as for Table 1.

Table 2

Fatty acid	Chemical formula	Relative rate of oxidation
Stearic acid	C ₁₇ H ₃₅ COOH	0.6
Oleic acid	C ₁₇ H ₃₃ COOH	6
Linoleic acid	C ₁₇ H ₃₁ COOH	64
Linolenic acid	C ₁₇ H ₂₉ COOH	100

The oxidation should preferably be performed under controlled conditions, so that after the oxidation process autooxidation is substantially prevented. Preferably the oxidized lipids should have a peroxide value as measured by AOCS Official Method Cd 8-53 of at least 20, preferably at least 30 and more preferably at least 40 meq/kg.

The lipids may be oxidized by any suitable method and by any suitable oxidation agent, for example by ozone, mixtures of ozone/air or ozone/oxygen.

10

At the oxidation process a series of peroxidic products may be formed, such as hydroperoxides, ozonides, diperoxides, peroxides and polyperoxides. Certain by-products may also be formed, for example ketones and aldehydes, which are less desired. These by-products may be removed by extracting the lipids with a solvent after the oxidation process. Alternatively volatile undesired substances may be removed by evaporation, for example under vacuum. A further possibility is to selectively remove said undesired substances by adsorption.

It has according to the invention been shown that pulp treated with oxidized lipids, especially ozonized triglycerides, have a significant ability to inhibit the growth of *Candida albicans* and other unwanted microorganisms such as *E. faecalis*, *E. coli* and *P. mirabilis*.

The amount of oxidized lipids added should be at least 0.05% of the total weight of the treated pulp.

25

The treated pulp may be mixed with untreated pulp and/or with superabsorbent material to form an absorbent core 4. An absorbent core can contain between 0.05 and 20% by weight, preferably between 0.2 and 15% by weight, more preferably between 0.5 and 10% by weight and most preferably between 1 and 5% by weight of added oxidized lipids calculated on the total weight of the hydrophilic fibers, for example pulp fibers, contained in the absorbent core.

The oxidized lipids may thus be added to the pulp, usually cellulosic fluff pulp, used in the absorbent core 4 of an absorbent article. Alternatively or in addition they may be added to

the topsheet 2 or any additional functional layer contained in the absorbent article, such as liquid receiving layer, liquid distribution layer, liquid storage layer etc.

At least a part of the treated pulp fibers in the core can be distributed only to certain areas
5 in the absorbent core 4. For example the treated pulp fibers are distributed or positioned in areas in the form of spaced apart islands. The proportion by weight of the hydrophobic microbe-inhibiting material in the aforementioned islands in the core can be 25-35 % by weight, calculated in relation to the total weight of the hydrophilic fibrous material in the core in the areas or the islands. In such areas, the proportion by weight of oxidized lipids
10 can be higher compared with the situation in which the oxidized lipids are uniformly distributed in a core, since a greater proportion by weight of liquid-absorbent fibers is present in adjacent parts of the liquid-absorbent core in order to compensate for impaired liquid absorption by the treated pulp fibers in the areas. The treated fibers can be mixed with other fibers and/or with superabsorbent material in different proportions. The
15 proportion of oxidized lipids should not be too high in the wetting area, because they may impair the absorption capacity of body liquid. The wetting area is located essentially in the central crotch part of the absorbent article.

In the same manner as in the absorbent core 4, the oxidized lipids can be uniformly
20 distributed in any other layer in the absorbent article, such as the topsheet, a liquid receiving layer, a liquid distribution layer or the like. The proportion by weight of the oxidized liquid in these layers can be the same as for the absorbent core. The oxidized lipids can also be distributed in certain areas of these layers in the same way as described with respect to the absorbent core.

25

Depending on the kind of absorbent article, the proportion of oxidized lipids may vary.

The oxidized lipids can be added to the pulp fibers, or other fibers, in conjunction with the production of the fibers or be added in the production apparatus in which the absorbent
30 articles are produced. The lipids may either be oxidized before being added to the fibers or after addition. In the latter case the fibers, for example pulp fibers, are treated with the lipids and the treated pulp is then reacted with the oxidizing agent, for example ozone. The ozone may then at the same time act as a bleaching agent for the pulp.

The amount of oxidized lipids added may vary dependant on the intended use. For example in personal hygiene higher amounts of the oxidised lipids may be used in the urogenital area, where it is an advantage that the lipids remain on the skin, than in hand or foot wiping, where it may be desired that only small amounts of the lipids may remain.

5

The hygiene tissue can contain between 0.001 and 15 g/g, preferably between 0.01 and 8 g/g, more preferably between 0.05 and 4 g/g and most preferably between 0.1 and 3 g/g of added oxidized lipids calculated on the total weight of the hygiene tissue. The amounts may differ dependant on the intended use.

10

Upon use of the hygiene tissues the probiotic bacteria and the oxidized lipid are preferably transferred and delivered to the skin thereby serving as a skin treatment agent.

The oxidized lipids and the probiotic bacteria may be added separately or premixed to hygiene tissue. If the oxidized lipids and the probiotic bacteria are added separately they may be distributed evenly throughout the hygiene tissue. Alternatively, the oxidized lipids and the probiotic bacteria may be localized in specific areas of the hygiene tissue, especially on the surface thereof, so as to be easily released from the hygiene tissue and transferred to the skin. When the oxidized lipids and the probiotic bacteria are localized in specific areas of the hygiene tissue, the oxidized lipids and the probiotic bacteria may be added separately to the hygiene tissue on different locations of the hygiene tissue.

One or more of the following components may be added to the hygiene tissue together with the oxidized lipid: a viscosity regulating agent, a carrier for the oxidized lipid or an agent for improving the adhesion of the composition to the skin. Quaternary tensides may be used as agents for improving the adhesion to skin. Other components which may be contained in the composition are cleaning agents, skin care agents, fragrances etc. Furthermore, it is important to keep the water activity of the composition very low in order to secure the survival of the probiotic bacteria.

30

The lipids may either be oxidized before being added to the fibers or after addition. The ozone may then at the same time act as a bleaching agent for the pulp, in case pulp fibres are present in the wipe.

The carrier material used in the hygiene tissue should be chosen so that it can hold the oxidized lipids in its porous structure and release it to the skin when the wipe is used.

Examples of suitable carrier materials are fibrous materials such as tissue paper, airlaid tissue and different type of nonwoven materials. Examples of nonwoven materials are
5 hydroentangled webs, spunbond, meltblown, thermobonded webs etc. Further examples of carrier materials are foams, nets, films etc. In the case of films the oxidised lipids may be applied between film layers and exposed when separating the film layers from each other and/or applied in formed recesses in the film.

- 10 The structure of the carrier material is important for its function to hold liquid substances. A material that is especially suitable in this respect is hydroentangled webs.

Fibres that are useful in fibrous carrier materials are pulp fibres, cotton fibres, bamboo fibres and other natural fibres, regenerated cellulose fibres such as viscose and lyocell as
15 well as syntethic polyolefin fibres, like polyethylene and polypropylene, polyester and mixtures thereof.

For a so called wet wipe a suitable fiber composition may be a mixture of viscose fibers and polyester fibers, for example 70 wt% viscose fibers and 30 wt% polyester.
20

A common fiber composition in other type of wipes is a mixture of pulp fibers and polypropylene.

A suitable basis weight for a personal hygiene wipe is between 30 and 70 g/m², preferably
25 between 40 and 50 g/m².

The size of the hygiene tissues may vary depending on its intended use. Examples of suitable sizes are 10x15 cm, 12x20 cm and 16x18 cm.

- 30 The composition comprising the oxidized lipids may be added to the carrier material by spraying, coating and impregnation.

If the sanitary article is an absorbent article the probiotic bacteria may be added to the topsheet, to the absorbent core or to an acquisition layer, being interposed between the
35 topsheet and the absorbent core. The oxidized lipids and the probiotic bacteria may be

added separately or premixed to the absorbent article. The probiotic bacteria may be added to a different location than the oxidized lipids or to the same location as the oxidized lipids. In order to achieve a good transfer to the user, the topsheet is preferred.

5 *Experimental section*

Ozonization of oil/fat

The ozone was generated in an Argenotox ozone generator, type GL, Hamburg, operated at a voltage of 150V an inlet oxygen flow of 63 l/h. 200 g of each tested oil/fat was treated during a time period of 2h with an ozone/oxygen flow of 0.061 g/min. The ozone concentration of the added gas was 58 g/m³.

For the strongly ozonized sunflower oil according to table 4, having a peroxide value of 276.9 meq./kg, ozone was bubbled through 50 g oil for 5.5 h. The strongly ozonized olive oil, with a peroxide value of 263.8 meq./kg, was prepared by addition of ozone to 50 g oil under 22 h.

The gas was bubbled through the oil which was contained in a vented vessel. A magnetic stirrer was used in the vessel. The solid fats were gently heated above melting temperature, after which the gas was bubbled through the liquid fats. The tested oils/fats are those stated in Table 3 below.

Table 3

	Saturated %	Single unsaturated %	Multiple unsaturated %	Quotient unsaturated/saturated
Sunflower oil	11	28	56	7,64
Olive oil	18	70	12	4,56
Rapeseed oil	7	62	31	13,29
Maize oil	12	28	55	6,92
Cacao butter	61	36	3	0,64

The degree of oxidation was tested by determining the peroxide value according to the test method AOCS Official Method Cd 8-53 Surplus 2003. The peroxide value for both the starting oils/fats and the ozonized oils/fats was determined. The results are given in Table 4 below.

Table 4

Oil	Peroxide value (meq/kg)
Rapeseed oil	3.82
Ozonized rapeseed oil	42.09
Maize oil	4.21
Ozonized maize oil	60.04
Olive oil	7.99
Ozonized olive oil	61.41
Sunflower oil	7.10
Ozonized sunflower oil	65.49
Cacao butter	3.32
Ozonized cacao butter	69.51
Strongly ozonized sunflower oil	276.9
Strongly ozonized olive oil	263.8

Test liquid 1

- 5 Sterile, synthetic urine to which a growth medium for microorganisms had been added. The synthetic urine contained monovalent and divalent cations and anions and urea and had been produced in accordance with the information in Geigy, Scientific Tables, vol. 2, 8th ed., 1981, page 53. The growth medium for the microorganisms is based on two common growth media, Hook and FSA medium for enterobacteria. The pH in this mixture
10 was 6.6.

Treatment of pulp with oils/fats

- Sheets of sulfate pulp from Weyerhaeuser Inc., with the designation NB416, were impregnated with a solution of the tested oil/fat in hexane. The solution contained 43%
15 ozonized oil/fat and 57% hexane. The solution was equally distributed over the surface of the sheets. About 5 gram of liquid was added per 5 gram of pulp. When the hexane had evaporated (after about 4 hours) the sheets contained 30% by weight oil/fat and 70% by weight pulp fibers. The treated sheets were defibrated in a Braun multimixer MX32 to produce fluff pulp.

Experiment 1**Bacterial growth measurements**

A homogenous mixture of fluffed pulp was prepared in the following way (Method 1):
Untreated and treated Weyerhaeuser pulp (NB416) was weighed in desired proportions
5 and put in Braun multimixer, MX32. The pulp was mixed about 30 seconds.

Absorbent cores for testing were produced in the following way (Method 2):
Absorbent cores were prepared using a slightly modified sample former according to
SCAN C 33:80. Fluffed pulp of the desired type(s) was weighed and a homogeneous
10 mixture of the fluffed pulp(s) was introduced into a flow of air having a negative pressure
of approximately 75mbar, through a pipe having a diameter of 10 mm and being equipped
at the bottom with a metal net. The fluff pulp was gathered on the metal net and thereafter
constituted the absorbent specimen. The absorbent core was compressed to a bulk within
the range of 6 to 12 cm³/g.

15 Two different types of absorbent cores were produced; the reference cores were
composed of 2.0g untreated Weyerhaeuser pulp (NB 416) and the test cores were
composed of a mixture of 1.4g treated Weyerhaeuser pulp (NB 416), treated with oxidized
sunflower oil (30 weight% oil), peroxide value 65.5 meq./kg, according to the method
20 described under "Treatment of pulp with oils/fats" above and 1.0g of untreated
Weyerhaeuser pulp (NB 416). This means that the test cores contained 15% ozonized
sunflower oil. The size of the absorbent cores was 5 cm in diameter.

The bacterial growth in the absorbent cores was measured in the following way:
25 Bacteria were cultured in nutrient broth and diluted in test liquid 1 to the desired
concentration of ca. $10^{3.3}$ cfu/ml (colony forming units/ml). 10 ml of test liquid 1 containing
bacteria were added to the test cores and each of the cores were placed in a sterile jar
(Nunc sputum/organ jars, 100 ml), and lids was fitted on the jars. The jars was turned
upside down and incubated in a warm cabinet at 35°C. After incubation for 0, 6 and 12
30 hours, the absorbent cores were each placed in a plastic bag with 90 ml peptone water
and the content was homogenized (agitated and worked up) in a stomacker for 3 minutes.
The homogenate was diluted in dilution tubes with peptone water and a microbiological
culture was spread on agar plates. Slanetz Bartley agar was used for *E. faecalis*, and
Drigalski agar for *E. coli* and *P. mirabilis*. The specimens were incubated at 35°C for 1-2
35 days before the colonies were counted.

The result is shown in Table 5, which clearly illustrates an reduction of all 3 test bacteria in the test cores after 6 and 12 hours, compared with the reference core in which all the bacteria grew well.

5

Table 5

Sample	0h (¹⁰ log cfu/ml)			6h (¹⁰ log cfu/ml)			12h (¹⁰ log cfu/ml)			pH		
	E.coli	P.mir.	E.faec.	E.coli	P.mir.	E.faec.	E.coli	P.mir.	E.faec.	0h	6h	12h
Test 1	3.5	3.2	3.2	<2	<2	<2	<2	<2	<2	6.2	5.9	5.6
Test 2	3.4	3.2	3.3	<2	<2	<2	<2	<2	<2	6.3	5.9	5.6
Test mv	3.5	3.2	3.3	<2	<2	<2	<2	<2	<2	6.2	5.9	5.6
Ref. 1	3.5	3.2	3.2	6.1	5.0	6.3	9.7	8.8	9.1	6.6	6.6	8.5
Ref. 2	3.4	3.2	3.3	6.5	5.1	6.2	8.8	7.8	8.1	6.6	6.6	8.6
Ref. mv	3.5	3.2	3.3	6.3	5.0	6.3	9.5	8.5	8.8	6.6	6.6	8.7

mv = mean value

Experiment 2

Survival of Lactobacillus plantarum, LB931, and Lactobacillus plantarum/brevis, LB87b, in synthetic urine on treated and untreated absorbent cores

Sheets of bleached kraft pulp produced by the company Weyerhaeuser, NB416, were fluffed in a laboratory hammermill. Sheets of the same pulp grade were also impregnated with ozonized oil. 1.6 of ozonized sunflower oil with a peroxide value of 276.9 meq./kg was dissolved in 23.4 g acetone. This solution was then thoroughly distributed over a sheet of NB416, weighing 25 g. The solution was rapidly absorbed by the pulp and seemed to be homogeneously distributed. After 4 h, the acetone had evaporated and a pulp sheet containing 6 % ozonized sunflower oil had been prepared. To another sheet, weighing 25 g, was added 10.7 g ozonized sunflower oil with a peroxide value of 276.9 meq./kg dissolved in 14.3 g acetone, according to the same procedure. This resulted in a sheet containing 30 % ozonized sunflower oil.

The pulp sheets containing, 6 % and 30 % ozonized sunflower oil, respectively, were fluffed in a

Braun Multimixer MX 32. The sheet was first torn by hand to pieces with a size of about 2 cm*2 cm and then about 5 g pulp at the time was agitated in the mixer at maximum intensity for about 30 s. After this treatment of the two samples, fluffed pulps with 6 % resp. 30 % ozonized sunflower oil had been prepared.

Pads of fluffed pulp were prepared by mixing untreated, fluffed NB416 and fluffed NB416 containing ozonized sunflower oil. Each pad contained 2 g pulp and different amounts of ozonized sunflower oil

Sample 1. 2 g untreated, fluffed NB416

Sample 2. 1,03 g untreated, fluffed NB416 and 1,03 g fluffed NB416 containing 6 % ozonized sunflower oil

Sample 3. 1,18 g untreated, fluffed NB416 and 1,18 g fluffed NB416 containing 30 % ozonized sunflower oil

This means that sample 1 contained just pulp fibres, sample 2 contained 3 % ozonized sunflower oil and sample 3 contained 15 % ozonized sunflower oil. Each sample was then mixed in the Braun Multimixer for 10 s at maximum intensity to achieve homogeneous fibre mixtures. These fibre mixtures were then used for preparation of circular, Ø 5 cm, pads using a PFI test piece former. This equipment is described in the standard method SCAN-C 33:80. The test pieces were then compressed with a load of 16 kPa for 10 s., which resulted in a density of 10-15 cm³/g. 12 test pieces of each sample were prepared.

The survival of LB931 and LB87b (Esum AB, Umeå Sweden) was measured in the following way. The lactobacilli were cultured in MRS broth to stationary phase. The suspension of each strain was diluted in test liquid 1 to a concentration of about 10⁴ - 10^{4.5} CFU/ml.

10 ml of test liquid 1 containing LB931 and LB87b respectively was added to the treated and the untreated absorbent cores, respectively, each placed in a sterile plastic jar, and the jars were covered with plastic lids. Two samples were prepared for each bacteria and absorbent core. The jars were incubated in a warm cabinet at 37°C. After incubation for 0 and 4 hours, the absorbent cores were each placed in a plastic bag with 20ml saline solution and the content was homogenized (agitated and worked up) in a stomacher for 3 minutes at high speed. The homogenate was diluted in dilution tube with saline solution and the suspension was spread on Rogosa agar plates. The plates were incubated at 37°C in 5% CO₂ for 2 days before the colonies were counted.

The results are shown in Fig. 4 and 5. As may be seen LB931 and LB87b survived and grew well in the untreated pad as well as in the pad treated with 3% ozonized oil. There was a small decline in

growth in the pad treated with 15% ozonized oil, which may indicate that lower concentration than 15% ozonized oil is preferred to assure a maintained survival for certain probiotic bacteria.

Experiment 3

Survival of *Lactobacillus fermentum*, Ess-1, in synthetic urine on treated and untreated absorbent cores

For preparation and test of absorbent cores, see experiment 2. However, in this test only samples 1 and 2 were prepared.

Sample 1. 2 g untreated, fluffed NB416

Sample 2. 1,03 g untreated, fluffed NB416 and 1,03 g fluffed NB416 containing 6 % ozonized sunflower oil. This means that sample 2 in total contained 3% ozonized sunflower oil.

The suspension of Ess-1 was diluted in test liquid 1 to a concentration of about $10^{3.5} - 10^{4.5}$ CFU/ml.

The result is shown in Fig. 6. Ess-1 survived and grew well in the untreated pad and remained on the start level in the pad treated with 3% ozonized oil.

Experiment 4

Survival of *Lactobacillus plantarum* LB 931 and *C. albicans* in synthetic urine on treated and untreated absorbent cores

A test has been performed to evaluate the effect of ozonized oil on survival of *Candida albicans* and of *Lactobacillus plantarum* LB931. Test liquid 1 as described above was prepared for the growth measurements. Fluffed pulp was prepared according to Method 1 and absorbent cores were prepared according to Method 2. However the oxidised oil was in this case oxidised sunflower oil having a peroxide value of 276.9 mmol/kg according to the method described under "Treatment of pulp with oils/fats" with the exception that acetone was used to dissolve the ozonized sunflower oil instead of hexane. This means that the untreated absorbent core contained just pulp fibres and the treated absorbent core contained 15% ozonized sunflower oil.

LB931 and *Candida albicans* were cultured in MRS and Todd Hewitt-broth respectively to stationary phase. The suspensions were diluted in test liquid 1 to a concentration of about $3,5 \times 10^4$ cfu/ml for LB931 and about $6,0 \times 10^3$ cfu/ml for *C. albicans*.

5 10 ml of test liquid 1 containing *Candida* and LB931 respectively was added to the treated and untreated absorbent cores, respectively, placed in a sterile plastic jar, and the jar was covered with aluminium foil. Two samples were prepared for each microorganism and absorbent core. The jars were incubated in a warm cabinet at 37°C. After incubation for 0, 4, 6 and 8 hours, the absorbent cores were each placed in a plastic bag with 20ml saline
10 solution and the content was homogenized (agitated and worked up) in a stomacher for 3 minutes at high speed. The homogenate was diluted in dilution tubes with saline solution and the suspension was spread on agar plates. Sabaroud-dextrose agar was used for *Candida* and MRS agar for LB931. The plates were incubated at 37°C (in 5% CO₂ for MRS plates) for 2 days before the colonies were counted.

15

The result is shown in Fig 7. As can be seen, the number of *C. albicans* had declined to zero in the treated absorbent core after 4 hours. The growth of LB931 was slightly inhibited in the treated product after 4 hours but seem to recover. It should be noted that this small inhibition of LB931 is only seen when using a high concentration of the
20 ozonized lipid. Both LB931 and *C. albicans* grew well in the untreated absorbent core.

Experiment 5

Survival of Lactobacillus plantarum LB931 and C. albicans in synthetic urine on treated and untreated absorbent cores

25

This test was performed to evaluate the effect of ozonized oil on survival of *C. albicans* and of *Lactobacillus plantarum* LB931.

Sheets of bleached kraft pulp produced by the company Weyerhaeuser, NB416, were
30 fluffed in a laboratory hammermill. Sheets of the same pulp grade were also impregnated with ozonized oil. 1.6 g of ozonized olive oil with a peroxide value of 263.8 meq./kg was dissolved in 23.4 g acetone. This solution was then thoroughly distributed over a sheet of NB416, weighing 25 g. The solution was rapidly absorbed by the pulp and seemed to be homogeneously distributed. After 4 hours the acetone had evaporated and a pulp sheet
35 containing 6 % ozonized olive oil had been prepared.

The pulp sheet containing 6 % ozonized olive oil was fluffed in a Braun Multimixer MX 32. The sheet was first torn by hand to pieces with a size of about 2 cm*2 cm and then about 5 g pulp at the time was agitated in the mixer at maximum intensity for about 30 s. After this treatment of the sample, fluffed pulp with 6 % ozonized olive oil had been prepared.

Pads of fluffed pulp were prepared by mixing untreated, fluffed NB416 and fluffed NB416 containing ozonized olive oil. Each pad contained 2 g pulp and different amounts of ozonized olive oil.

10

Sample 1. 2 g untreated, fluffed NB416

Sample 2. 1,03 g untreated, fluffed NB416 and 1,03 g fluffed NB416 containing 6 % ozonized olive oil

15 This means that sample 1 contained just pulp fibres and sample 2 contained 3 % ozonized olive oil. Each sample was then mixed in the Braun Multimixer for 10 s at maximum intensity to achieve homogeneous fibre mixtures. These fibre mixtures were then used for preparation of circular, Ø 5 cm, pads using a PFI test piece former. This equipment is described in the standard method SCAN-C 33:80. The test pieces were then
20 compressed with a load of 16 kPa for 10 s., which resulted in a density of 10-15 cm³/g. 18 test pieces of each sample were prepared.

LB931 and *Candida albicans* were cultured in MRS and Todd Hewitt-broth, respectively, to stationary phase. The suspensions were diluted in test liquid 1 to a concentration of
25 about 10^{4.4} cfu/ml for LB931 and about 10^{4.3} cfu/ml for *C. albicans*.

10 ml of test liquid 1 containing *Candida* and LB931 respectively was added to the treated and untreated absorbent cores, respectively, which were each placed in a sterile plastic jar. The jar was tightly covered with aluminium foil. Two samples were prepared for each
30 microorganism and each absorbent core. The jars were incubated in a warm cabinet at 37°C. After incubation for 0, 2, and 6 hours, the absorbent cores were each placed in a plastic bag with 20ml saline solution and the content was homogenized (agitated and worked up) in a stomacher for 3 minutes at high speed. The homogenate was diluted in dilution tubes with saline solution and the suspension was spread on agar plates.
35 Sabaroud-dextrose agar was used for *Candida* and Rogosa agar for LB931. The plates

were incubated at 37°C (in 5% CO₂ for the Rogosa agar) for 2 days before the colonies were counted.

The result is shown in Fig 8. As can be seen, the number of *C. albicans* declined to a very low value in the treated absorbent core after only 2 hours. Hence, a growth inhibiting effect on *C. albicans* may be seen at the low concentration of ozonized oil of 3 %. This low value remained after 6 hours. The growth of LB931 in the treated absorbent core was not affected by the ozonized oil. Both LB931 and *C. albicans* grew well in the untreated absorbent core.

10

Experiment 6

Survival of Lactobacillus plantarum/brevis LB87b and C. albicans in synthetic urine on treated and untreated absorbent cores

15 This test was performed to evaluate the effect of ozonized oil on survival of *C. albicans* and of *Lactobacillus plantarum/brevis* LB87b.

For preparation of the absorbent cores and the test on survival and growth, see experiment 5.

20

LB87b and *Candida albicans* were cultured in MRS and Todd Hewitt-broth, respectively, to stationary phase. The suspensions were diluted in test liquid 1 to a concentration of about 10^{4.7} cfu/ml for LB87b and about 10^{4.7} cfu/ml for *C. albicans*.

25 The result is shown in Fig 9. As can be seen, the number of *C. albicans* declined to zero in the treated absorbent core after 6 hours. The survival of LB87b in the treated absorbent core was only marginally affected by the ozonized oil. Both LB87b and *C. albicans* grew well in the untreated absorbent core.

CLAIMS

1. A sanitary article such as a sanitary napkin, panty liner, incontinence protector, diaper, tampon, wet wipe, hygiene tissue, said article comprising probiotic
5 bacteria and at least one oxidized lipid.
2. Sanitary article according to claim 1, wherein the oxidized lipids have been oxidized under controlled conditions.
- 10 3. Sanitary article according to claim 1 or 2, wherein the oxidized lipids have a peroxide value as measured by AOCS Official Method Cd 8-53 of at least 20, preferably at least 30 and more preferably at least 40 meq/kg.
- 15 4. Sanitary article according to any of the preceding claims, wherein said oxidized lipids are oxidized by treatment with ozone.
5. Sanitary article according to any of the preceding claims, wherein the lipids are fatty acids or derivatives thereof.
- 20 6. Sanitary article according to claim 5, wherein the fatty acid derivatives are esters of fatty acids, especially triglycerides.
7. Sanitary article according to claim 5 or 6, wherein at least part of the fatty acids and/or fatty acid derivatives are unsaturated.
- 25 8. Sanitary article according to any of the preceeding claims, wherein said probiotic bacteria are lactic acid producing bacteria.
9. Sanitary article according to any of the preceeding claims, wherein said
30 sanitary article comprises 10^5 to 10^{11} CFU, preferably 10^8 to 10^{10} CFU probiotic bacteria.
10. Sanitary article according to any of the preceding claims, wherein said sanitary articles is an absorbent article such as a sanitary napkin, a panty liner, an

incontinence protectors, a diaper or a tampon, wherein said absorbent article comprises an absorbent core (4).

- 5 11. Absorbent article according to claim 10, wherein said absorbent core (4) comprises hydrophilic fibers treated with said oxidized lipids.
12. Absorbent article according to claim 11, wherein at least part of said hydrophilic fibers are cellulose fibers.
- 10 13. Absorbent article according to claim 11 or 12, wherein to said absorbent core (4) it has been added at least 0.05% by weight of the oxidized lipids, calculated on the total weight of the hydrophilic fibers contained in the absorbent core.
14. Absorbent article according to claims 11 to 13, wherein to said absorbent core
15 (4) it has been added between 0.05 and 20% by weight, preferably between 0.2 and 15% by weight, more preferably between 0.5 and 10% by weight and most preferably between 1 and 5% by weight of the oxidized lipids, calculated on the total weight of the hydrophilic fibers contained in the absorbent core.
- 20 15. Absorbent article according to any of the claims 10 to 14, wherein the article further comprises a fluid impervious backsheet, a liquid-pervious topsheet (2) and/or one or more additional functional layers selected from: liquid receiving layers, liquid distribution layers.
- 25 16. Absorbent article according to claim 15, wherein to the topsheet and/or to at least one of said additional functional layers it has been added at least one oxidized lipid.
17. Absorbent article according to claim 16, wherein to said topsheet or additional
30 functional layer it has been added at least 0.05% by weight of the oxidized lipids, calculated on the total weight of said topsheet and/or additional functional layer.
18. Absorbent article according to claim 17, wherein to said topsheet and/or
35 additional functional layer it has been added between 0.05 and 20% by weight,

preferably between 0.2 and 15% by weight, more preferably between 0.5 and 10% by weight and most preferably between 1 and 5% by weight of the oxidized lipids, calculated on the total weight of the topsheet and/or additional functional layer.

5

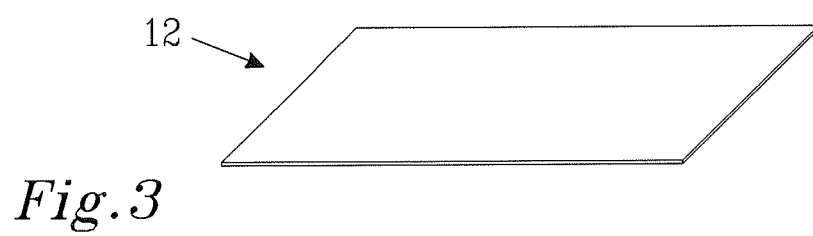
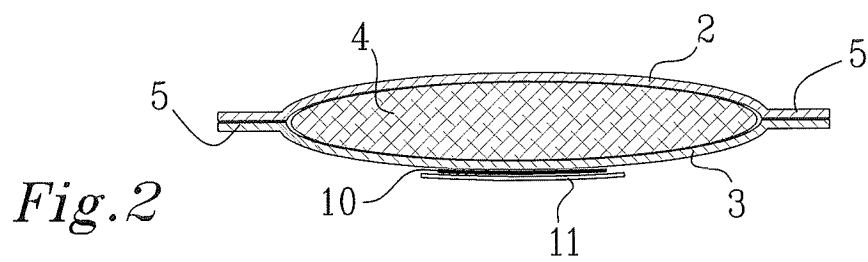
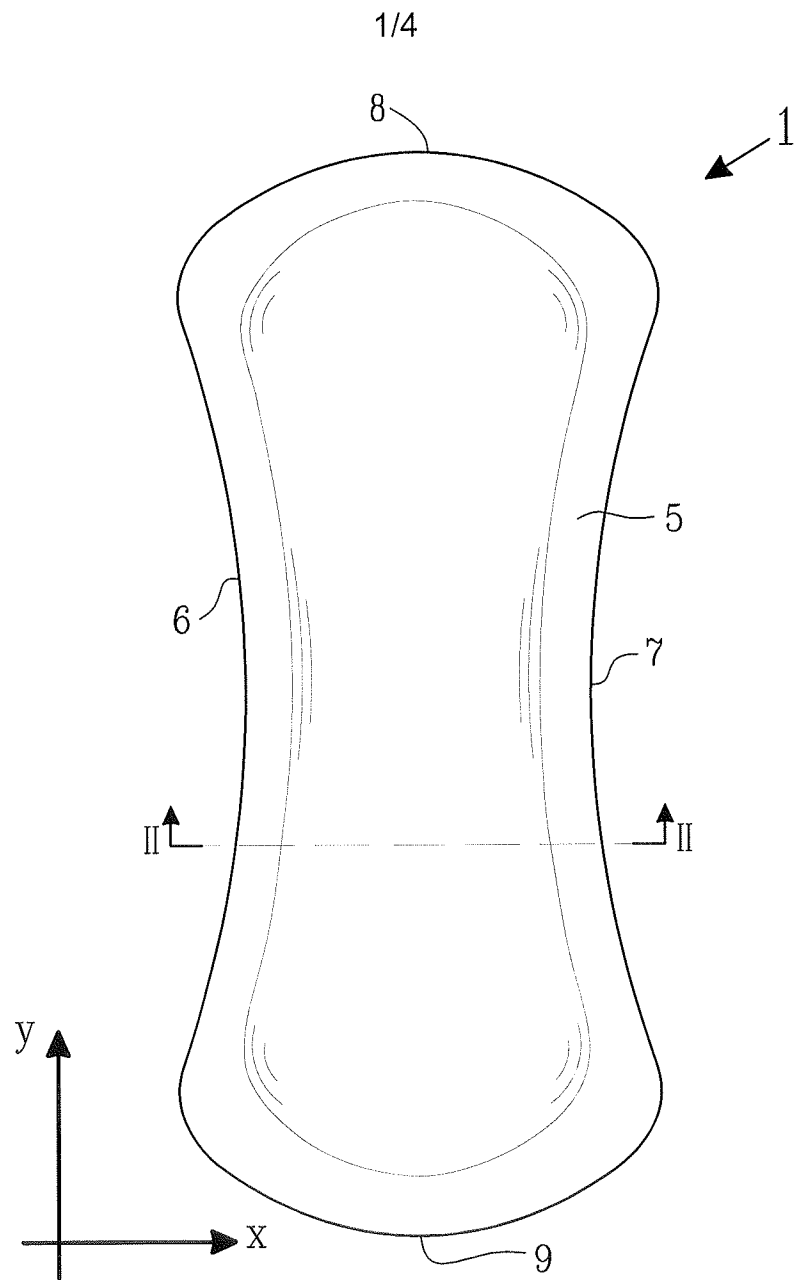
19. Absorbent article according to any of claims 15 to 18, wherein probiotic bacteria have been added to the topsheet.

10

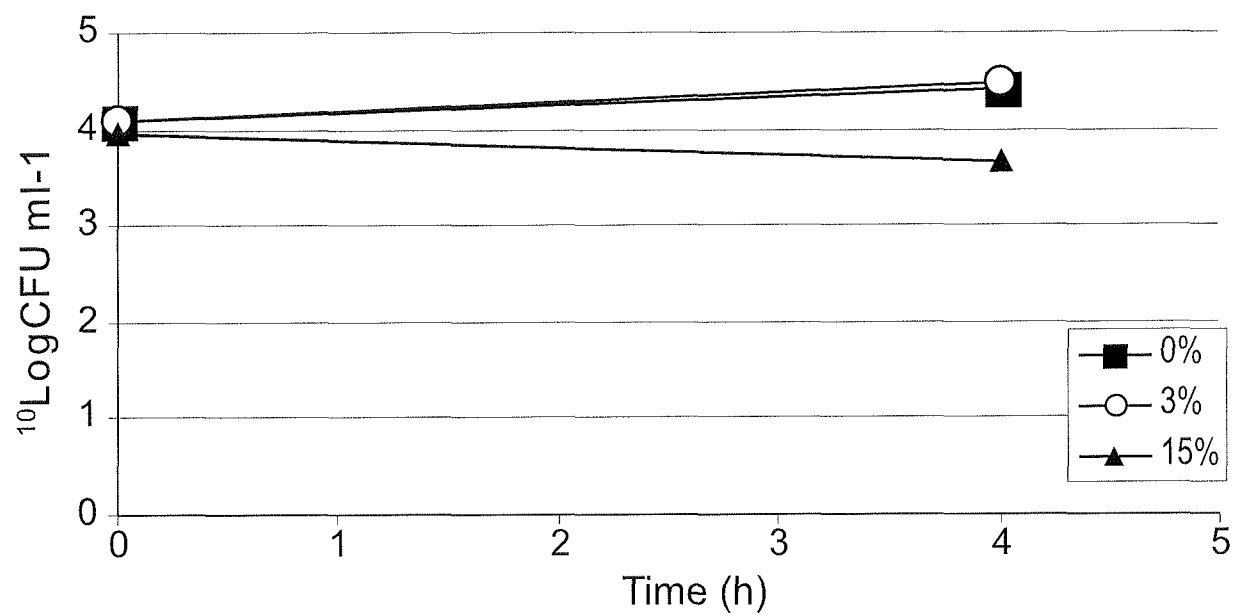
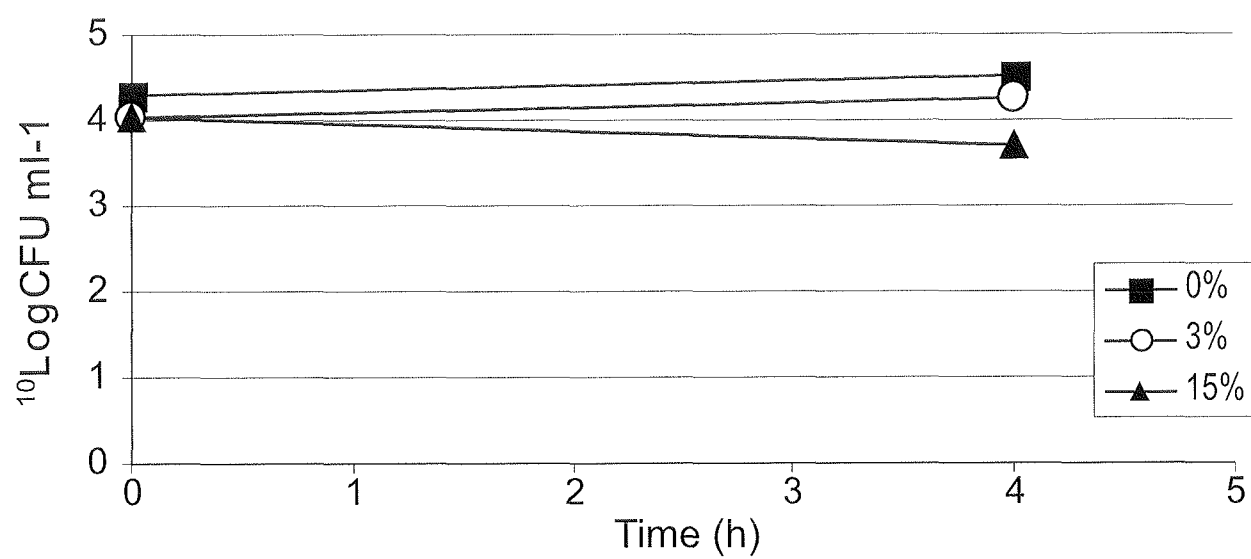
20. Sanitary article according to any of claims 1 to 9, wherein said sanitary article is a hygiene tissue, such as a wet wipe, dry wipe, washcloth, patch, towelette or napkin.

15

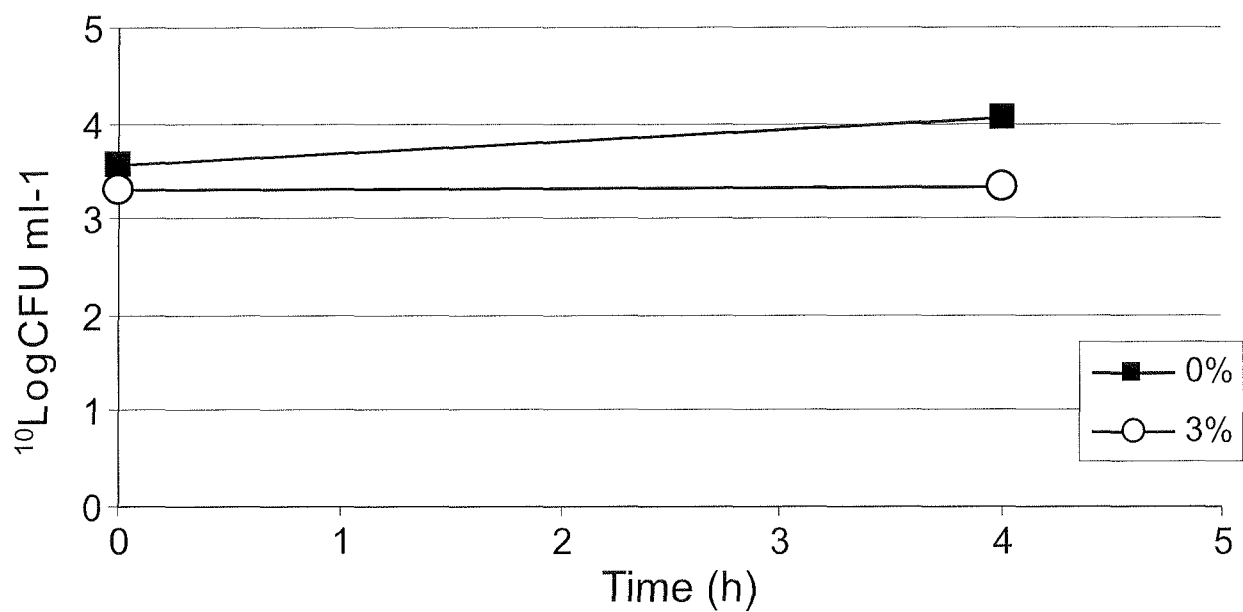
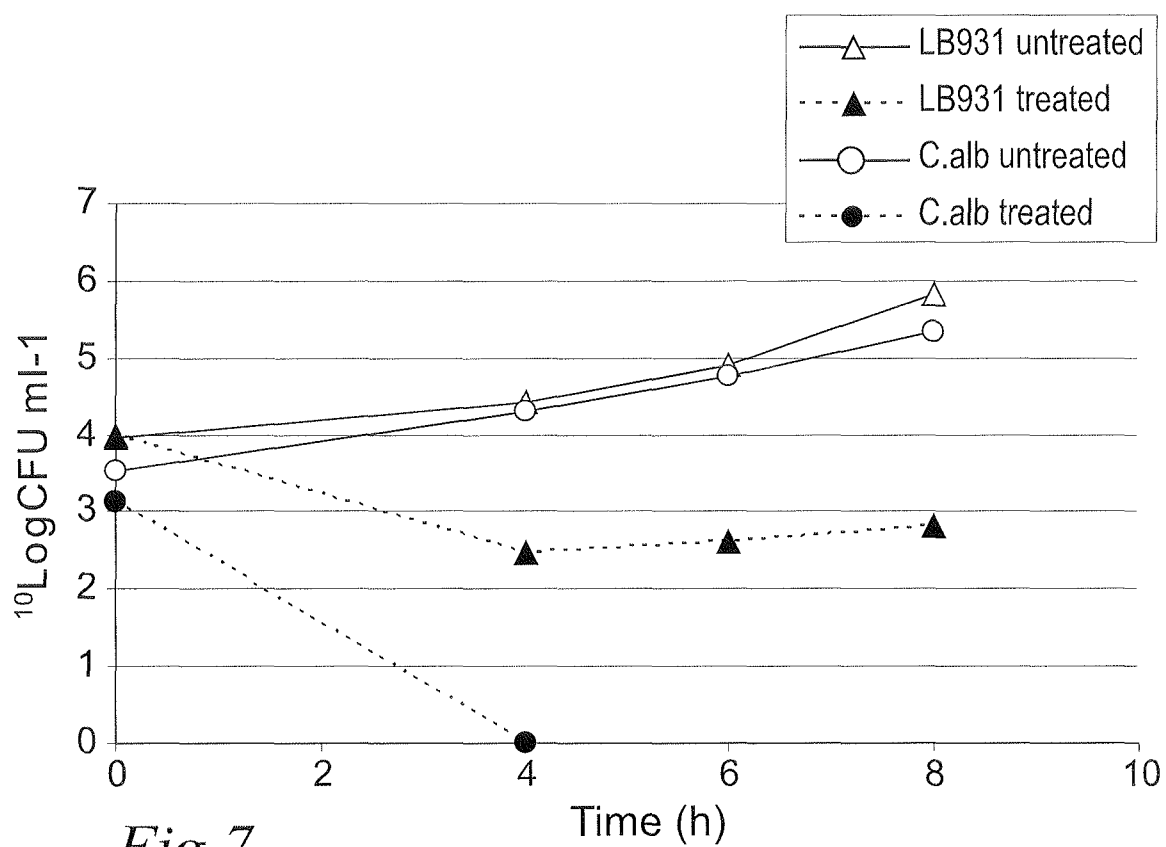
21. Hygiene tissue according to claims 20, wherein said hygiene tissue contains between 0.001 and 15 g/g, preferably between 0.01 and 8 g/g, more preferably 0.05 g/g and 4 g/g and most preferably between 0.1 and 3 g/g of added oxidized lipids calculated on the total weight of the hygiene tissue.



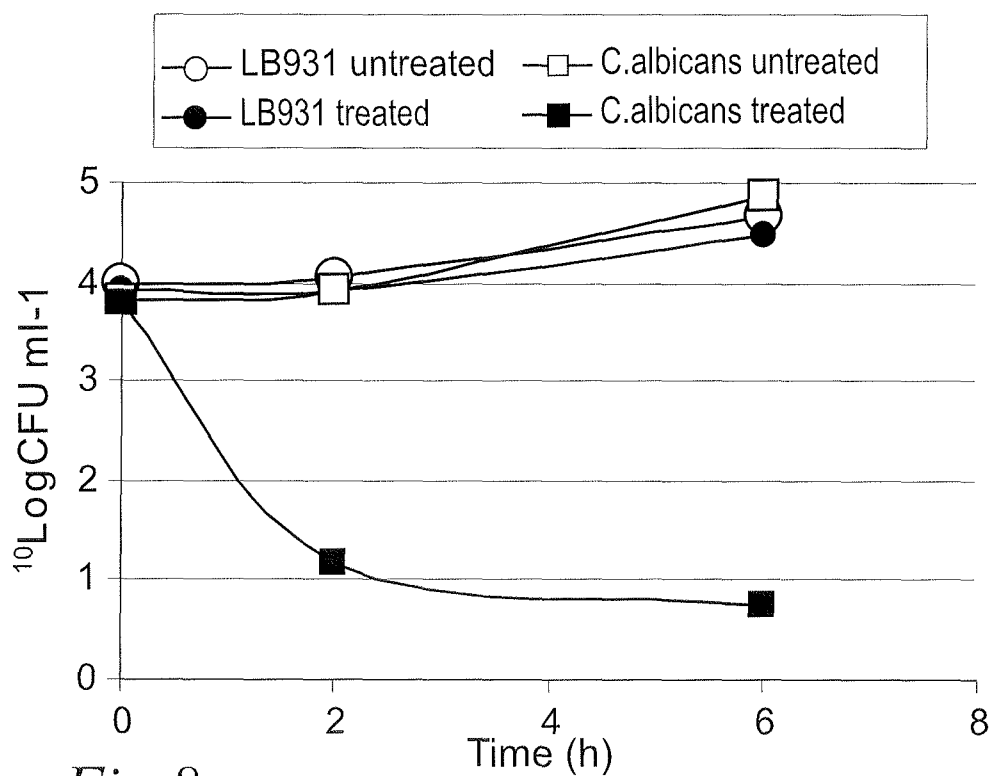
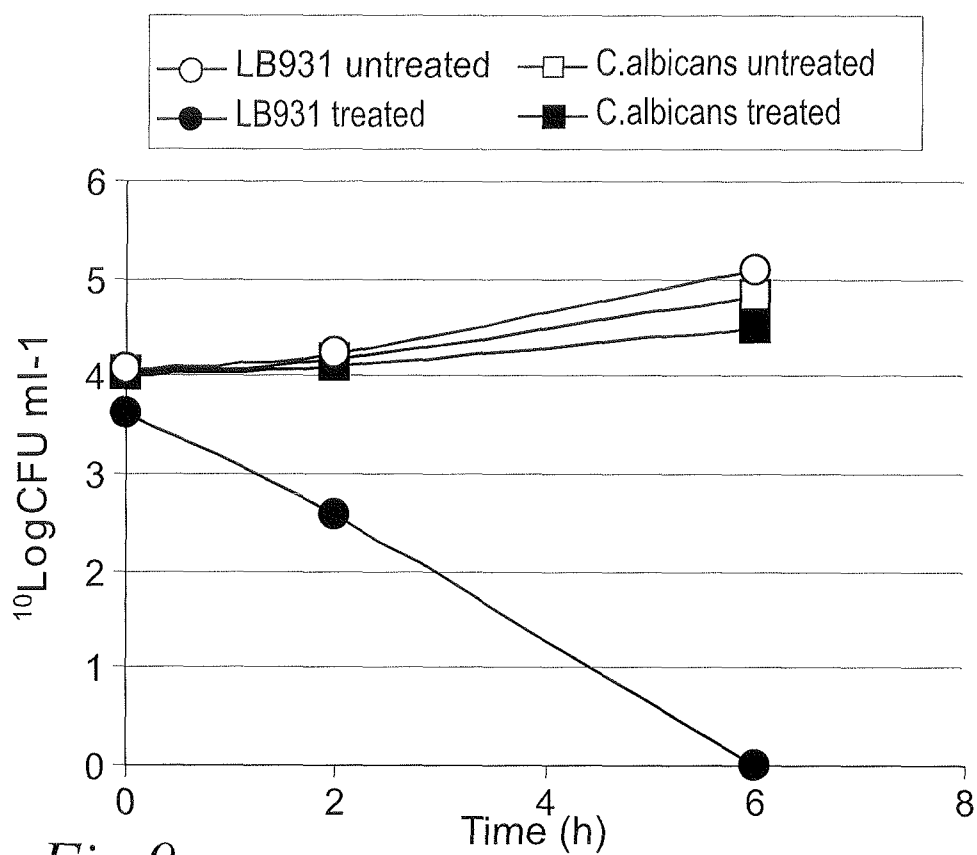
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*Fig.4**Fig.5*

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*Fig.6**Fig.7*

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*Fig.8**Fig.9*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2009/050491

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A61F, A61L, A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, MEDLINE, COMPENDEX, EMBASE, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004101008 A1 (SCA HYGIENE PRODUCTS AB), 25 November 2004 (25.11.2004), abstract --	1-21
A	GB 1282889 A (GRILLO-WERKE AKTIENGESELLSCHAFT), 26 July 1972 (26.07.1972), claim 1 --	1-21
A	US 20010033838 A1 (FARMER), 25 October 2001 (25.10.2001), paragraphs [0110],[0133] --	1-21
A	US 20080300558 A1 (BRUSK ET AL), 4 December 2008 (04.12.2008), claim 20, abstract, [0096] --	1-21

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

21 December 2009

Date of mailing of the international search report

22-12-2009

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

David Shanks/ELY
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2009/050491

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1273295 A1 (GOMEZ MORALED A, MANUEL-ANTONIO ET AL), 8 January 2003 (08.01.2003), claims 18,24, abstract, example 5 -- -----	1-21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2009/050491

International patent classification (IPC)

A61L 15/46 (2006.01)
A61F 13/15 (2006.01)
A61L 15/36 (2006.01)
A47K 7/00 (2006.01)
A61K 35/74 (2006.01)
A61K 8/02 (2006.01)

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Cited literature, if any, will be enclosed in paper form.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2009/050491

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