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(54) **Cheese packaging**

(57) The present invention relates to a package for white mould rind cheese products with improved shelf life. The package comprises the cheese loaded on a support; a moisture absorbent agent and a thermoplastic film having an oxygen transmission rate of at least 18,000 cm³ /m²-day-bar (at 23°C and 0% RH) which encloses

both the cheese product loaded on the support and the moisture absorbent agent. The moisture absorbent agent comprises an inorganic salt selected from NaCl, KCl and CaCl₂ and a super-absorbent polymer.

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Description**Disclosure of Invention**

[0001] The present invention relates to a package for products sensitive to humidity, in particular cheese with a white mould rind, capable to increase the shelf life of the product.

[0002] The white mould rind typical of the surface of certain cheeses is a mix of live microorganisms. For example, on camembert the microorganism mix is: *Penicillium Camambertii* and *Geotrichum Candidum*. For a correct metabolism the microorganisms on the surface of the cheese require a balanced equilibrium of environmental conditions, such as the gas composition and the moisture level in the surrounding atmosphere. A lack of oxygen or an excess of humidity can destroy this equilibrium and deteriorate the product very quickly.

[0003] A correct metabolism is fundamental not only for aesthetical reasons, as it reflects on the color and texture of the rind, but mainly for the development of the typical flavour of the cheese.

[0004] Typically, white mould rind cheeses, such as brie or camembert, are packaged in a cellulose or OPP foil overwrap, often enclosed in a wooden or cardboard box. This type of packages is not hermetically sealed. The shelf life of the product thus packaged is relatively short. For example, the normal shelf life of a white mould rind cheese packaged in the conventional manner is approximately 3 weeks at a temperature of about 6°C.

[0005] Packaging systems comprising a rigid container having a thermoplastic film hermetically sealed on the periphery of the container or trays overwrapped by a hermetically sealed thermoplastic film are commonly used in retail stores as they offer several advantages: for instance the hermetic seal protects the product from contamination, the transparency of the thermoplastic film allows the consumer to inspect the product.

[0006] However any attempt to store white mould rind cheese products in hermetically sealed plastic containers has so far been unsuccessful due to the very stringent metabolic requirements of the microorganisms involved.

[0007] It is therefore an object of the present invention to provide a hermetically sealed package for white mould rind cheese products which increases the shelf life of such products. The package is characterised by a high permeability to gases that allows gaseous exchange with the outer atmosphere and by a controlled level of humidity within the package.

[0008] In fact it has been found that for the preservation of the cheese product in hermetically sealed packages the package not only needs to possess high gas permeability but also the ability to maintain the humidity in the package within a certain range. When the humidity level in the package is too low the cheese product tends to dry out. On the other hand if the humidity level is too high the cheese deteriorates quickly.

[0009] The package of the present invention comprises a support, a white mould rind cheese product loaded on the support, a moisture absorbent agent comprising an inorganic salt selected from NaCl, KCl and CaCl₂ and a super-absorbent polymer and a thermoplastic film having an oxygen transmission rate (measured according to ASTM D-3985 at 23°C and 0% relative humidity) of at least 18,000 cm³ /m²-day-bar enclosing said cheese product loaded on said support and said moisture absorbent agent.

[0010] The high oxygen transmission rate of the film provides the package with the appropriate rate of gaseous exchange. The moisture absorbent agent keeps the humidity level in the package within an optimal range.

[0011] Typical supports suitable for the package of the invention are made of mono-layer or multi-layer thermoplastic materials either foamed or solid. Suitable multi-layer thermoplastic material comprise at least one substrate layer and one heat-sealable surface layer. The substrate layer may be of foamed polypropylene, foamed polystyrene or foamed polyester. Alternatively the substrate layer may be chosen from the group of solid polystyrene, polyester, polypropylene, polyethylene, polyamide and the like. The heat-sealable surface layer comprises materials chosen from the group of ethylene homo- and co-polymers, propylene homo- and co-polymers, ionomers and the like as well as blends of these polymers in any proportions. Suitable blends for the heat-sealable layer also include peelable blends. Additional layers can be present in the multi-layer structure, such as tie or adhesive layers, bulk layers and the like.

[0012] Suitable mono-layer thermoplastic materials for the support can be selected from foamed polypropylene, foamed polystyrene, foamed polyester or solid polystyrene, polyester, polypropylene, polyethylene and the like.

[0013] The thickness of the support is typically comprised between 100 and 3,000 µm, preferably between 300 and 1,000 µm.

[0014] The supports are in the form of trays, with a bottom wall and upwardly extending side-walls.

[0015] Typically the support exceeds the size of the cheese product not only in the horizontal dimensions but also in the vertical one, i.e. the height, to avoid direct contact between the surface of the cheese product and the thermoplastic film in the final package.

[0016] The moisture absorbent agent for the package of the present invention comprises at least two components: an inorganic salt selected from the group of NaCl, KCl and CaCl₂ and a super-absorbent polymer. It is believed that the inorganic salt and the super-absorbent polymer have a synergistic effect on the improvement of the shelf-life of white mould rind cheese products. The inorganic salt component regulates the humidity level in the package whereas the super-absorbent polymer captures the liquid that forms as a consequence of the inorganic salt activity.

[0017] Preferably the moisture absorbent agent comprises NaCl.

[0018] Examples of super-absorbent polymers that may suitably be employed in the moisture absorbent agent of the present invention include: poly(acrylic acid) salts, poly(acrylate) salts, poly(vinyl alcohol-acrylic acid) salts, poly(isobutylene-maleic acid) salts, poly(ether)-based non ionic polymers, sodium carboxymethylcellulose, poly(vinylpyrrolidone), acrylonitrile-grafted starch, acrylic acid grafted-starch, and the like polymers.

[0019] The super-absorbent polymer is selected from the group of salts of homo- or co-polymers of acrylic or methacrylic acids or partially saponified polyacrylate or polymethacrylate polymers. Preferably the super-absorbent polymer will contain an ammonium or alkali metal salt of homopolymers of acrylic or methacrylic acids or copolymers thereof with ethylenically unsaturated comonomers, or a partially saponified polyacrylate or polymethacrylate polymer. Super-absorbent polymers suitable for food packaging pertaining to the class of poly(acrylic acids) and poly(acrylates) are commercially available from e.g. The Dow Chemical Company and BASF.

[0020] The amount of moisture absorbent agent present in the package ranges from 1 to 50 g, from 2 to 40 g, from 4 to 30 g depending on the weight of the cheese product and/or the size of the package. The appropriate amount of the moisture absorbent agent can be determined for each cheese weight/package size combination with routine experiments.

[0021] The ratio by weight of the inorganic salt to the super-absorbent polymer in the moisture absorbent agent may range from 95:5 to 5:95, from 85:15 to 15:85, from 75:25 to 25:75, from 65:35 to 35:65. The ratio by weight of the inorganic salt to the super-absorbent polymer in the moisture absorbent agent can also be 50:50.

[0022] The moisture absorbent agent can be in the form of a free-flowing powder or granules. The cheese product and the moisture absorbent agent are then separated by a membrane of a perforated thermoplastic film or of any other suitable moisture permeable material. Preferably no direct contact exists between the cheese product and the moisture absorbent agent itself to avoid drying of the cheese product.

[0023] For instance the moisture absorbent agent may be loaded at the bottom of the support with a membrane of a perforated thermoplastic film placed over it. The membrane may be simply laid over the moisture absorbent agent or it may be fixed to the walls of the support at a distance from the moisture absorbent agent, for instance by means of sealing or of physical engagement, to form a separate compartment within the support. The cheese product is then placed over the membrane. The membrane can be of any thermoplastic material, preferably of a suitable thickness to support the weight of the product.

[0024] Alternatively the moisture absorbent agent may be enclosed in a sachet made of a suitable moisture permeable material. Suitable moisture permeable materials are for instance films made of intrinsically moisture permeable thermoplastic polymers, perforated films of impermeable thermoplastic polymers, non-woven materials and the like. For instance the sachet could be made of a first layer of a thermoplastic material, such as an ethylene homo- or copolymer, provided with perforations and a second layer of a non-woven material, the two layers being sealed around their edges to contain the moisture absorbent agent.

[0025] The moisture absorbent agent could also be placed within a conventional absorbent pad used in the packaging of food products. Suitable absorbent pads are for instance those described in US 6,270,873, US 5,176,930 or WO 92/04254. Depending on its structure it may be possible that a suitable amount of a super-absorbent polymer is already contained in the absorbent pad. In this case to obtain the moisture absorbent agent of the package of the invention it would only be necessary to include in the pad an appropriate amount of the inorganic salt component.

[0026] The sachet (or pad) containing the moisture absorbent agent can be placed anywhere inside the support, although it is preferred that no direct contact exists between the cheese product and the sachet containing the moisture absorbent agent to reduce the risk of excessively drying the cheese product in the contact areas. For instance the sachet could be divided in at least two areas: a first area which does not contain any moisture absorbent agent and which is placed in direct contact with the product and a second area which contains the moisture absorbent agent and which is not in direct contact with the product. The first area could be positioned on the bottom wall of the support underneath the cheese product and the second area could be laid over one of the upwardly extending side-walls of the support.

[0027] The thermoplastic film of the package of the invention may be of any kind provided it has an oxygen transmission rate (OTR), measured according to ASTM D-3985 at 23°C and 0% relative humidity (RH), of at least 18,000, 20,000, 21,000 or even 25,000 cm³ /m²-day-bar. The thermoplastic film is non-perforated, i.e. it is not provided with perforations or microperforations in order to attain the desired level of oxygen permeability. As used herein, the term "film" is used in a generic sense to include a plastic web, regardless of whether it is film or sheet. Films used in the present invention can have any total thickness desired, so long as the film has the desired oxygen transmission properties. Typically, the film has a thickness of 250 μm or less, from 150 to 10 μm, from 100 to 15 μm.

[0028] In general, the film used in the present invention can be a monolayer film or a multilayer film. The film may be produced using conventional techniques. The films may be produced by extrusion and optionally monoaxial or, preferably, biaxial orientation. Biaxially oriented films may be either heat-shrinkable or non heat-shrinkable. As used herein, the term "heat-shrinkable film" is used with reference to films which exhibit a free shrink at 120° C of at least 30% in both directions.

[0029] Suitable polymers for the thermoplastic films include ethylene homo- and copolymers, poly(vinylalcohol), styrene

butadiene block copolymers, especially styrene ethylene butadiene block copolymers, and the like. Ethylene homopolymers include high density polyethylene (HDPE) and low density polyethylene (LDPE). Ethylene copolymers include ethylene/alpha-olefin copolymers and ethylene/unsaturated ester copolymers. Ethylene/alpha-olefin copolymers generally include copolymers of ethylene and one or more comonomers selected from C₃ to C₂₀ alpha-olefins, such as 1-butene, 1-pentene, 1-hexene, 1-octene, 4-methyl-1-pentene and the like. Ethylene/alpha-olefin copolymers generally have a density in the range of from about 0.86 to about 0.94 g/cm³. The term linear low density polyethylene (LLDPE) is generally understood to include that group of ethylene/alpha-olefin copolymers which fall into the density range of about 0.915 to about 0.94 g/cm³ and particularly about 0.915 to about 0.925 g/cm³. Lower density ethylene/alpha-olefin copolymers may be referred to as very low density polyethylene (VLDPE) and ultra-low density polyethylene (ULDPE). Among the ethylene copolymers suitable polymers are for instance ethylene/butyl acrylate copolymers, ethylene/alpha-olefin copolymers having a density less than 0.92 g/cm³, ethylene/methyl acrylate copolymers having a methyl acrylate content of from 20 to 24 mole percent, ethylene/vinyl acetate copolymers having a vinyl acetate content of from 10 to 30 mole percent.

[0030] In a first embodiment of the package of the invention the thermoplastic film completely encloses the support holding the cheese product and the moisture absorbent agent forming a hermetically sealed envelope around them. Packages of this type can be made using conventional horizontal form-fill-and-seal machines.

[0031] If the thermoplastic film used is a heat-shrinkable one the envelope may be heat-shrunk around the support to give a taut package by means of a heat-treatment at the end of the packaging process.

[0032] The moisture absorbent agent when enclosed in a sachet is preferably placed inside the support with the product. Alternatively it can be placed outside the support, enclosed between the thermoplastic film and the support holding the product.

[0033] When in the form of free-flowing powder or granules the moisture absorbent agent is preferably placed within the support, separated from the cheese product by a suitable moisture permeable membrane.

[0034] In a second embodiment of the package of the present invention the thermoplastic film is sealed around the periphery of the support. In this embodiment both the cheese product and the moisture absorbent agent are placed in the support. This type of package can be made using conventional tray-lidding packaging machines and processes.

[0035] The package of the present invention is suitable for the packaging of slices of white mould rind cheese or preferably of whole cheese products.

[0036] The present invention will be illustrated by some examples, however the present invention is not limited to these examples.

[0037] EXAMPLE 1

[0038] 30 samples of a commercial white mould rind cheese (Chamois d'or; weight about 200 g) were removed from their original package (non hermetic perforated polyethylene wrapping in a paperboard box) and placed in packages according to the present invention composed as follows:

- Support: polypropylene tray;
- Moisture absorbent agent: 6 g of a mix of NaCl + super-absorbent polyacrylate polymer (Luquasorg FP800 supplied by BASF) in a weight ratio 75:25. The moisture absorbent agent was placed on the bottom of the tray and it was separated from the cheese by means of a perforated thermoplastic sheet;
- Thermoplastic film: LDPE /ULDPE/LDPE three-layer film with a thickness of 40 µm and an OTR (0% RH, 23 °C) of 18,000 cm³ /m² -day-bar.

[0039] The thermoplastic film was wrapped and hermetically sealed around the tray using a conventional horizontal form-fill-and-seal packaging machine.

[0040] The packages according to the present invention, together with an equivalent number of references of the same lot in their original package, were stored at 7-8 °C for 60 days.

[0041] Every 10 days a part of the samples of the inventive package and of the reference was opened and evaluated for:

[0042] - organoleptic properties (appearance, odor, taste, texture) with scores ranging from 1 to 5 from the very good to the very bad (Table 1).

[0043] - head space composition in terms of ammonia.

Table 1

	Taste		Odor		Texture		Appearance	
Days	Ref.	Invention	Ref.	Invention	Ref.	Invention	Ref.	Invention
0	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1

(continued)

Days	Taste		Odor		Texture		Appearance	
	Ref.	Invention	Ref.	Invention	Ref.	Invention	Ref.	Invention
30	1	1	1	1	1	1	1	1
40	1	1	1	1	1	1	1	1
50	2	1	2	1	1	2	2	1
60	3	2	4	2	2	2	4	2

[0044] After 50 days from the beginning of the test there is a strong deterioration of the product stored in the original package while the products stored in the package of the present invention maintain their organoleptic properties up to 60 days.

[0045] The odor of the product is strongly influenced by the ammonia developed by the degradation of proteins, whose concentration in the head space was monitored during the test. The amount of ammonia produced is significantly lower in the packages of the invention at long storage times confirming that the degradation of the cheese product is slower in the inventive package than in conventional non-hermetic packages.

[0046] EXAMPLES 2-5

[0047] 30 samples of a commercial white mould rind cheese (Chamois d'or, weight about 200 g) were removed from their original package (non hermetic perforated polyethylene wrapping in a paperboard box) and placed in a package according to the present invention composed as follows:

- Support: polypropylene tray with polyethylene liner
- Moisture absorbent agent: 13 g of a mix of NaCl + super-absorbent polyacrylate polymer (Luquasorg FP800 supplied by BASF) in a weight ratio 23:77. The moisture absorbent agent was placed on the bottom of the tray and it was separated from the cheese by means of a perforated thermoplastic sheet; alternatively 20 g of a mix of NaCl + super-absorbent polyacrylate polymer (Luquasorg FP800 supplied by BASF) in a weight ratio 50:50 were inserted in an adsorbent pad having a first water impermeable side in contact with the cheese and a second porous side in contact with the bottom of the tray;
- Thermoplastic film: LDPE /ULDPE/LDPE three-layer film with a thickness of 40 μm and an OTR (0% RH, 23 °C) of 18,000 cm^3/m^2
- day-bar hermetically sealed on the periphery of the tray . Alternatively a different LDPE /ULDPE/LDPE three-layer film with a thickness of 25 μm and an OTR (0% RH, 23 °C) of 25,000 cm^3/m^2 -day-bar hermetically sealed on the periphery of the tray.

[0048] The packages were prepared on a conventional tray-lidding machine without head space modification.

[0049] The packages according to the present invention, together with an equivalent number of references of the same lot in their original package, were stored at 4-6 °C for 3 weeks. The organoleptic properties (appearance, odor, texture) of all the samples at the end of the 3 weeks are reported in Table 2, with scores ranging from 1 to 5 from the very good to the very bad.

[0050]

Table 2

Example	Film OTR (cm^3/m^2 -day-bar)	Moisture Absorbent	Appearance	Odor	Texture
2	18,000	Powder	1	1	1
3	18,000	Pad	1	1	1
4	25,000	Powder	1	1	1
5	25,000	Pad	1	1	1
Reference	-	-	1	1	1

[0051] The cheese maintains the same organoleptic properties as in the original packages up to 3 weeks after packaging, which is the current shelf life for this type of products. However, compared to previous tests carried out with hermetically sealed packages which showed a reduced shelf-life with a strong modification of the typical taste with

respect to conventional non-hermetic packages this is an improved result.

[0052] EXAMPLE 6 AND COMPARATIVE EXAMPLES 1 AND 2

[0053] 30 samples of a commercial white mould rind cheese (Camembert weight about 200 g) were removed from the original package (non hermetic perforated polyethylene wrapping in a paperboard box) and placed in packages according to the invention composed as follows:

- Support: polypropylene tray with polyethylene liner
- Moisture absorbent agent:
- Example 6: 13 g of a mix of NaCl + super-absorbent polyacrylate polymer (Luquasorg FP800 supplied by BASF) in a weight ratio 23:77;
- Comparative Example 1: 10 g of super-absorbent polyacrylate polymer (Luquasorg FP800 supplied by BASF);
- Comparative Example 2: 5 g of NaCl
- Thermoplastic film: LDPE /ULDPE/LDPE three-layer film with a thickness of 25 μm and an OTR (0% RH, 23 °C) of 25,000 cm^3/m^2 -day-bar hermetically sealed on the periphery of the tray.

[0054] The packages were prepared on a conventional tray-lidding machine without head space modification (air). The absorbent agent (inventive moisture absorbent agent, super-absorbent polymer or NaCl), in a powder form was placed at the bottom of the tray and it was separated from the cheese by means of a perforated thermoplastic sheet.

[0055] The packages, together with an equivalent number of references of the same lot in their original package, were stored at 4-6 °C for 30 days. At the end of the 30 days the samples and the references were opened and their organoleptic properties (appearance, odor, taste) were evaluated with scores ranging from 1 to 5, from the very good to the very bad.

[0056]

Table 3

	Appearance	Odor	Taste
Ex. 6	1	1	1
Comp. Ex. 1	4	5	5
Comp. Ex. 2	3	1	1 (3)
Reference	3	3	3

[0057] The cheese in the package of the invention maintains good organoleptic properties for a longer time than the cheese in the reference package whose normal shelf life is approximately 3 weeks.

[0058] The results in Table 3 also show the synergistic effect of the inorganic salt and the super-absorbent polymer component of the moisture absorbent agent of the inventive package. The products packed without the inorganic salt component (Comp. Ex. 1) undergo a much faster deterioration than the products packed in the inventive package (Ex. 6) or in the reference package. The products packed without the super-absorbent polymer component (Comp. Ex. 2) maintain their overall organoleptic properties for a period of time which is comparable with the period of time of the products packed in the inventive package (Ex. 6). However their appearance and their taste are negatively influenced by the liquid that forms at the bottom of the package when the inorganic salt component absorbs the excess moisture in the package. In particular the taste scores 1 in the areas not in contact with the liquid but only 3 in the areas of contact.

Claims

1. A hermetically sealed package comprising a) a support; b) a white mould rind cheese loaded on said support; c) a moisture absorbent agent comprising an inorganic salt selected from NaCl, KCl and CaCl_2 and a super-absorbent polymer; and d) a thermoplastic film having an oxygen transmission rate of at least 18,000 cm^3/m^2 -day-bar at 23°C and 0% RH enclosing said cheese product loaded on said support and said moisture absorbent agent.
2. The package according to claim 1 wherein the inorganic salt is NaCl.
3. The package according to any preceeding claim wherein the super-absorbent polymer is chosen from the group of salts of homo- or co-polymers of acrylic or methacrylic acids or partially saponified polyacrylate or polymethacrylate polymers.

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4. The package according to any preceeding claim wherein the ratio by weight of the inorganic salt to the super-absorbent polymer ranges from 85:15 to 15:85.
- 5 5. The package according to any preceeding claim wherein the moisture absorbent agent is placed in the support as a free-flowing powder and is separated from the cheese by a membrane of a perforated thermoplastic material.
6. The package according to any one of claims 1 to 4 wherein the moisture absorbent agent is enclosed in a moisture permeable sachet.
- 10 7. The package according to any preceeding claim wherein the thermoplastic film forms a hermetically sealed envelope around the support.
8. The package according to any one of claims 1 to 6 wherein the thermoplastic film is sealed around the periphery of the support.

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European Patent
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EUROPEAN SEARCH REPORT

Application Number
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A	EP 1 285 861 A (CRYOVAC INC [US]) 26 February 2003 (2003-02-26) * paragraph [0026] *	1-8	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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