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(54) **CONTAINER MADE FROM
THERMOPLASTIC MATERIAL FOR A
PRODUCT TO BE PROTECTED FROM
LIGHT**

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(57) **ABSTRACT**

The invention relates to a container such as a bottle, flask, tank or similar for housing a product to be protected from light, said container being made from a thermoplastic material and produced by blowing or by draw-blowing of a preform, characterised in that said container has a layer of thermoplastic material loaded in a homogeneous manner with mica flakes at a level of 2 to 4% by weight with the addition of titanium oxide powder at a level of 2 to 4% by weight.

CONTAINER MADE FROM THERMOPLASTIC MATERIAL FOR A PRODUCT TO BE PROTECTED FROM LIGHT

[0001] The present invention relates to improvements made to containers such as bottles, flasks, cans or the like, intended to contain products that have to be protected from the light, these containers being made of a thermoplastic and manufactured by blow-molding or stretch-blow-molding of a preform.

[0002] Certain products are adversely affected by the action of light.

[0003] This is particularly the case with milk, the taste of which changes under the effect of light, whether this be natural light or, to a far lesser extent, artificial light.

[0004] This affected taste, known as the "light taste" develops in two forms:

[0005] An "activated" taste (the taste of cabbage, a cooked taste or a mushroomy taste) which appears very quickly,

[0006] an oxidation taste (the taste of cardboard, paper, metal or an oily taste) which develops more slowly.

[0007] These unpleasant tastes are generated by several phenomena:

[0008] breakdown of the amino acids and proteins, particularly with breakdown of methionine, which is the main cause of the "activated" taste;

[0009] conversion of vitamins, particularly a significant loss of water-soluble vitamins, for example riboflavin, which is one of the causes of the "activated" taste, and a breakdown of the fat-soluble vitamins, for example retinyl

[0010] palmitate (vitamin A) at wavelengths shorter than 450 nm;

[0011] oxidation of unsaturated fatty acids, which is the main cause of the oxidized taste.

[0012] The influence of light varies also according to the treatment to which the milk has been subjected.

[0013] Finally, the onset of the unpleasant light taste in milk is dependent on several parameters:

[0014] the quantity of light (light intensity and duration of exposure) received by the milk,

[0015] the wavelengths of the radiation,

[0016] the sensitivity of the product itself,

[0017] the temperature.

[0018] In particular, it would seem that the light taste is caused essentially by radiation at wavelengths shorter than 550 nm, in several windows of the visible and ultraviolet spectrum. The International Milk Federation therefore recommends the use of packaging allowing only 2% transmission of light at 400 nm and 8% transmission at 500 nm.

[0019] Finally, the thickness of the material and the volume/surface area ratio of the packaging also influence the onset of the bad taste.

[0020] From the foregoing explanations it will have been readily appreciated that the time for which milk or dairy products are kept may be lengthened if the protection against light can be made more effective.

[0021] Trials have been performed with tinted bottles. This has resulted in better keeping of the milk than with transparent or translucent bottles, but it has not proved to be possible to give the milk a good shelf life under the required conditions.

[0022] The solution very widely used for marketing long-life milk consists in manufacturing a multilayer container formed of at least three thin layers of thermoplastic materials (for example HDPE) bonded together, at least one of the internal layers being filled with pigments rendering it opaque to the light (an internal layer that is black in long life bottles). The shelf life may then achieve the conditions required by the market. The same solution may be applied to PET: however, in this case, the manufacture of the initial preform is substantially complicated and expensive; furthermore, delamination of the layers may subsequently occur.

[0023] In general, the known solutions that are currently in use or conceivable, are complicated to implement, and are expensive and very complicated in the case of PET.

[0024] The users (manufacturers of containers and packages) therefore have a pressing need for containers made of thermoplastic (such as polyethylene terephthalate PET, polyethylene naphthalate PEN, high density polyethylene HDPE) that provides the product with effective protection against the effect of light, but which is simpler to manufacture and less expensive than the corresponding containers currently available.

[0025] To these ends, the invention proposes a container as mentioned in the preamble, which is characterized in that it comprises a layer of thermoplastic filled homogeneously with mica flakes to a level of 2 to 4% by weight with the addition of powdered titanium oxide to a level of 2 to 4% by weight.

[0026] According to a preferred embodiment of the invention, the container is made of a monolayer of filled plastics material forming the aforesaid layer, which leads to a simpler and less expensive process for manufacturing the container. However, at least for certain applications, the invention does not set aside the embodiment that consists in the container being externally coated with a sleeve which hugs it tightly and is made of a filled thermoplastics material constituting the aforesaid layer.

[0027] By virtue of the arrangements according to the invention, a light-barrier effect is conferred, to a certain extent, by the mica pigments alone and, to a lesser extent, by the titanium oxide powder alone. By contrast, a particularly effective effect is afforded by the combination of the mica pigments and of the titanium oxide powder. This light-barrier effect is particularly manifest for wavelengths shorter than about 550 nm, that is to say specifically for the radiation that plays the greatest part in the milk degradation process.

[0028] Because the light-barrier effect is afforded by all the micro flakes of mica which are dispersed within the thermoplastics material and form a physical barrier to the propagation of light, it is necessary for these micro flakes to be present in sufficient number to be capable of forming a continuous barrier able to afford the desired effect.

[0029] However, on the other hand, the presence of the micro flakes of mica (which is a heat insulator) may impede the heating of the mass of thermoplastic material when said layer is being manufactured. Also, when the container is made of a monolayer, it is absolutely essential that it be possible for the preform to be heated correctly prior to the blow-molding or stretch-blow-molding step, and it is also necessary for the fill of mica micro flakes to be present in a proportion that does not impede the correct progress of the blow-molding or stretch-blow-molding process during manufacture of the container.

[0030] Likewise, an excessive proportion of titanium oxide powder needs to be avoided because of the thickening of the heated plastic paste and the ensuing impediment this is in the manufacture of the container.

[0031] A proportion not exceeding about 8% by weight, for the two additives combined, seems to satisfactorily meet these contradictory requirements.

[0032] Finally, both mica pigments and titanium oxide are products that it is desirable to introduce into the thermoplastics material in only a minimum dose in order not to modify the mechanical properties of the container for its manufacture and its use. In order to meet this requirement while at the same time complying with the constraints mentioned above which are intended not to disrupt the process of manufacturing the container, provision is preferably made for the mica to be present at a level of about 2 to 4% by weight and for the titanium oxide to be present at a level of about 2 to 4% by weight in respective proportions such that the combination is restricted to about 4% by weight. Typically, the desired results can be obtained by making provision for the mica to be present at about 2% by weight and the titanium oxide at about 2% by weight.

[0033] More specifically, the light-barrier effect is optimised if the mica micro flakes are all arranged parallel to one another with partial overlap and parallel to the surface of the wall of the container (arranged like roof tiles); it is thus possible to be sure that there are no straight paths through the thickness of the wall of the container along which light can reach the product contained in the container.

[0034] Particularly in the case of a monolayer container, the required positioning of the micro micro flakes is obtained, naturally, during the blow-molding or stretch-blow-molding process that the thermoplastics preform has to undergo in order to result in the final container with bi-oriented molecules: the double stretching (axial and radial) leading to biorientation at the same time causes the micro flakes to be orientated in the required roof tiles arrangement, without there being any need to anticipate an additional treatment step in order to achieve this.

[0035] The arrangements according to the invention find a preferred application in the manufacture of containers in

which the light-barrier layer is obtained from a thermoplastics material chosen from polyethylene terephthalate PET, polyethylene naphthalate PEN and high density polyethylene HDPE.

[0036] As already apparent from the foregoing explanations, the invention is aimed at the particularly beneficial, although nonexclusive and nonlimiting, application of milk bottles formed of a PET monolayer filled with mica flakes and titanium oxide powder to form a barrier to the light, allowing milk to be kept for sufficient time, without deterioration to the taste of the milk. Typically, a bottle made of a PET monolayer filled with 2% by weight of mica and 2% by weight of titanium oxide allows long-life milk to be kept for longer than the three months required by the legislation under average storage conditions.

[0037] As is also apparent from the foregoing explanations, the invention is not, however, restricted to the field of the preservation of milk or dairy products and may find application in the preservation of other light-sensitive products such as oils for example, especially olive oil, or alternatively beer.

1. A container, such a bottle, flask, can or the like, intended to contain a product that needs to be protected from the light, this container being made of a thermoplastic and manufactured by a blow-molding or stretch-blow-molding of a preform, wherein said container comprises a layer of thermoplastic filled homogeneously with mica flakes to a level of 2 to 4% by weight with the addition of powdered titanium oxide to a level of 2 to 4% by weight.

2. The container as claimed in claim 1, wherein said container consists of a monolayer of filled plastics material forming the aforesaid layer.

3. The container as claimed in claim 1, wherein said container is externally coated with a sleeve which grips it snugly and is made of a filled thermoplastic constituting the aforesaid layer.

4. The container as claimed in, claim 1, wherein the mica is present to a level of about 2 to 4% by weight and the titanium oxide to a level of about 2 to 4% by weight in respective proportions such that the combination represents about 4% by weight.

5. The container as claimed in claim 4, wherein the mica is present at a level of about 2% by weight and the titanium oxide is present at a level of about 2% by weight.

6. The container as claimed in claim 1, wherein the thermoplastic is chosen from polyethylene terephthalate PET, polyethylene naphthalate PEN and high density polyethylene HDPE.

7. A milk bottle, which is formed as claimed in claim 1.

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