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(54) **SCENTED CONTAINER WITH MOISTURE CONTROL CAPACITY**

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(57) **ABSTRACT**

A multifunctional vessel which includes an outer container, a moisture control material, and a scented material placed within or formed as part of the outer container, wherein the scented material includes a plastic composition, preferably a thermoplastic material, blended with a scent imparting material. The scented material can be formed in the shape of an inner container for holding an adsorbing composition, such as a gas adsorbing material. Alternatively, the scented material can be layered in the vessel to form an inner layer of the outer container and the moisture control material can be placed in a separate canister or sachet. The moisture control material can be placed in a container, such as a canister or a sachet, wherein the moisture control material regulates the relative humidity within the vessel.

SCENTED CONTAINER WITH MOISTURE CONTROL CAPACITY

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part application claiming priority from U.S. patent application Ser. No. 11/525,388, filed on Sep. 22, 2006, which claims priority from U.S. Provisional Application Ser. No. 60/720,138, filed on Sep. 23, 2005. This application is also a continuation-in-part application claiming priority from U.S. patent application Ser. No. 10/996,916, filed on Nov. 24, 2004, which is a continuation-in-part application claiming priority from U.S. patent application Ser. No. 10/328,579, filed on Dec. 24, 2002, which application claims priority from provisional application 60/375,841, filed on Apr. 25, 2002.

BACKGROUND OF INVENTION

[0002] One embodiment of the invention relates to multifunctional vessels, such as pharmaceutical or neutraceutical vessels, containing a moisture control material and a scented material, each of which may be placed within, secured within or forming a portion of the multifunctional vessel. An embodiment of the invention also relates to vessels for holding commercial products that require a predetermined relative humidity level within the vessel yet can be enhanced by the presence of a particular scent within the vessel.

[0003] Some products which are packaged in conventional vessels, such as conventional glass or plastic bottles, have an unpleasant and/or unappetizing odor. An example is the odor produced by fish oil capsules. In current practice, the odor of these products may escape from the vessel, thereby creating an unpleasant environment.

[0004] In other situations the products are enhanced when particular scents are present in the vessels.

[0005] The use of scented oils with selected plastic materials is known for certain limited applications. For example, U.S. Pat. No. 3,553,296 discloses a process for manufacturing a scented polyolefin that may have utility as an artificial flower, in the cosmetic industry or for the preparation of garbage bags. A method of providing scent to a product vessel by entrapping scented oil within a polymer matrix within the vessel, wherein the vessel is comprised of a material which is incompatible with the scented oil, is disclosed in U.S. Pat. No. 4,540,721.

[0006] In addition, there are products which require the maintenance of controlled levels of relative humidity within vessels. These products may include pharmaceutical products, dental products and consumer products, such as various tobacco products. These products require the regulation of moisture within the vessel in which they are shipped. To maintain these products at a desired relative humidity, it is often necessary to include a humectant in the vessel.

[0007] In addition, some products degrade when they are exposed to gases, such as oxygen, for extended periods of time. Reduced levels of those gases within the vessels for those products may be difficult to maintain once the vessel has been opened. To address these problems a gas absorbing material can be placed within the vessel. One particularly useful gas absorber is an oxygen absorber.

[0008] Notwithstanding the examples of the use of scented plastic materials, humectants, and oxygen absorbers, the concept of preparing a multifunctional vessel containing a moisture control material and a scented insert or container has not been disclosed. Further, incorporation of a scent imparting material as a component of a multifunctional container for use within vessels that also require the regulation of relative humidity has not been disclosed. Such products show great utility for solving multiple problems that exist with various types of products placed within conventional vessels.

[0009] In addition, utilization of a scented material to form an inner layer of a multifunctional vessel that also regulates the relative humidity within that vessel provides a surprising decrease in unwanted odors from products present in the vessels. The addition of a color pigment to such a vessel can add further utility to the vessels.

[0010] These and other objects are obtained by the composition, process for the preparation of the composition and process of use of the composition.

SUMMARY OF THE INVENTION

[0011] The invention includes a multifunctional vessel containing a moisture control material and a scented material, comprising a plastic composition blended with a scent imparting material, and optionally a color pigment and/or other additives, placed within the multifunctional vessel.

[0012] The invention further includes a multifunctional vessel containing a moisture control material and a scented material, wherein the scented material is a component of a gas adsorbing container, particularly an oxygen absorbing container, which is placed within the multifunctional vessel.

[0013] The invention further includes a multifunctional vessel containing a moisture control material and a scented material, wherein the scented material is formed, at least partially, of an absorbent polymeric composition, wherein the absorbent polymeric composition comprises a single polymeric material and at least one gas absorber, and wherein the quantity of the gas absorber within the polymeric material is substantial.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The invention comprises a multifunctional vessel useful for holding a variety of commercial products that may have unpleasant odors, such as pharmaceuticals, neutraceuticals, food or tobacco products, which vessel contains a moisture control material and a scented material, wherein the scented material is at least partially produced from a plastic composition blended with a scent imparting material, wherein the scented material is located within, is secured within or forms a portion of the multifunctional vessel and wherein the moisture control material is preferably contained in a canister, sachet or perforated container.

[0015] In one embodiment the multifunctional vessel comprises a conventional container manufactured from conventional materials, such as plastic or glass. Placed within this vessel is the scented material and the moisture control material. The scented material is preferably formed from a plastic material blended with the scent imparting material. Among the plastic materials that can be utilized are a single thermoplastic material that is compatible with the products which are placed within the vessel and/or which can be easily blended with the desired scent imparting material. Alternatively, the plastic materials can include more than one thermoplastic or thermoset material. The plastic materials may be selected from thermoplastic materials such as, but not limited to, polystyrenes, polyolefins, polyethylene, polypropylene, polyacrylates, polymethacrylates, polyamides, polyesters, and polyvinyl chloride. Non-limiting examples of copolymers include: styrene-butadiene rubbers (SBR), styrene-ethylene-butadiene-styrene copolymers (SEBS), butyl rubbers, ethylene-propylene rubbers (EPR), ethylene-propylene-diene monomer rubbers (EPOM), ethylene-vinyl acetate copolymers (EVA), ethylene-acrylate or butadiene-acrylonitrile, maleic anhydride modified polymers and copolymer, and grafted copolymers. In one preferred embodiment, where a single thermoplastic is utilized, the plastic material is polypropylene or polyethylene, preferably a high density polyethylene.

[0016] In another preferred embodiment, the multifunctional vessel can be produced solely or partially from an adsorbent polymeric composition, which includes one or more thermoplastic materials and at least one adsorbent material for adsorbing gases, such as oxygen, and/or other chemical compounds, as described hereinafter. (For purposes of this invention, the terms "absorbent" or "absorbing" and "adsorbent" or "adsorbing" have the same, all encompassing meaning.) The thermoplastic material can be any material that exhibits thermoplastic properties, including but not limited to, a single thermoplastic material, such as polypropylene or polyethylene, a copolymer of two or more monomers, a mixture of two or more polymers from single monomers, a mixture of two or more copolymers and a mixture of at least one polymer from a single monomer and at least one copolymer. Non-limiting examples of polymers from single monomers include: polystyrenes, polyolefins, polyethylene, polypropylene, polyacrylates, polymethacrylates, polyamides, polyesters, and polyvinyl chloride. Non-limiting examples of copolymers include: styrene-butadiene rubbers (SBR), styrene-ethylene-butadiene-styrene copolymers (SEBS), butyl rubbers, ethylene-propylene rubbers (EPR), ethylene-propylene-diene monomer rubbers (EPDM), ethylene-vinyl acetate copolymers (EVA), ethylene-acrylate or butadiene-acrylonitrile, maleic anhydride modified polymers and copolymers, and grafted copolymers.

[0017] When blends of thermoplastic materials are used, it has been observed that one of the components of the thermoplastic blends tends to enrich at the surface together with the adsorbent material while the other component tends to enrich towards the center of the composition. However, it has been discovered that only in the melted state will the adsorbent material tend to migrate towards the surface of the composition. Care must be taken to prepare such articles so that the adsorbent materials and the thermoplastic material exhibit the separation described hereinafter while in the molten or flowable state. For example, the thermoplastic material may be prepared from a blend of linear low density polyethylene (LLDPE), low density polyethylene (LDPE) and ethylene vinyl acetate (EVA) copolymer, wherein each of the components includes an ethylene monomeric unit. "Separation" as used herein defines a concentration gradient difference and does not necessarily mean 100% separation of the components into distinct phases. Similarly, "layered" as used herein means a significant change in concentration gradient such that the product appears to be layered, and does not necessarily mean a layer of one component and a second layer of a different component. "Gradient" means that the concentration of any component of the absorbing polymeric material varies with distance from the surface of a product manufactured from the absorbing polymeric material.

[0018] In order to achieve this phase separation, it has been found preferable to use as a thermoplastic component a blend of at least one polymer derived from a single monomer with at least one copolymer. Preferably the copolymer contains the monomer of the single monomer component so that the two polymers are compatible. If two or more copolymers are mixed to form the thermoplastic material, they should preferably contain at least one common monomer. The adsorbent can be any material capable of adsorbing a selected gaseous material, such as oxygen, from a surrounding atmosphere, or any material capable of adsorbing or otherwise removing other chemical compounds, such as, but not limited to, carbon dioxide, carbon monoxide, ethylene and amine complexes, from the atmosphere. Herein, the term "adsorbent" includes but is not limited to the term absorbent.

[0019] The relative concentration of thermoplastic material to adsorbent may vary depending on the thermoplastic material and the absorbent used. In a preferred embodiment, the polymeric structure comprises from about 20 wt % to about 85 wt % thermoplastic material and from about 15 wt % to about 80 wt % adsorbent.

[0020] Where applicable, compositions of the adsorbent polymeric composition further include appropriate quantities, up to about 10 percent, of organic or inorganic additives that are useful in the field of plastic such as plasticizers, stabilizers, elastomers, dyes and pigments. The composition may be customized to include certain pigments and/or colorants. It is often desirable that the manufactured article have a particular color. A particular color may, for example, enhance aesthetic appeal of the article and may serve to identify the particular brand or manufacturer. Suitable pigments of black, white or colored pigments, as well as extenders may be used. Examples of useful pigments include, without limitation, titanium oxide, zinc oxide, zinc sulfide, barium sulfate, aluminum silicate, calcium silicate, carbon black, black iron oxide, copper chromite black, yellow iron oxides, red iron oxides, brown iron oxides, ocher, sienna, umber, hematite, limonite, mixed iron oxide, chromium oxide, Prussian blue, chrome green, chrome yellow, manganese violet and other well known pigments. Dyes may be employed instead of pigments or in addition to the pigments.

[0021] Surprisingly, it has been found that products formed from the absorbent polymeric compositions exhibiting an accumulation of absorbing agent in a "migration zone" in a gradient towards the surface show distinct advantages in adsorbency compared to structures that contain the same concentration of adsorbing agent throughout the product (monolithic structures) and structures that contain an adsorbing agent only at the surface.

[0022] The polymeric structure of the adsorbent polymeric composition is produced by forming and setting the thermoplastic material after it has been dosed with the adsorbent. The polymeric structure may be produced by common plastic manufacturing processes, such as extrusion, co-extrusion, injection molding, bi-injection molding, blow molding, and any other methods that involve melting the thermoplastic material to an essentially liquid state. For example, the polymeric structure may be produced by the steps of heating the selected thermoplastic material (or combination of materials) until the thermoplastic is viscous, adding the selected adsorbent, blending the adsorbent into the melted thermoplastic, extruding the thermoplastic-adsorbent blend, and cooling the thermoplastic-adsorbent blend. The polymeric structure can then be cut or ground or processed by other means known in the art. Preferably the blend should be produced using a low shear technique, i.e. less than about 100 s^{-1}.

[0023] The composition of this embodiment is prepared such that the adsorbing agent tends to concentrate in a gradient within the migration zone near the surface of the polymeric composition. In a preferred embodiment, the concentration of the adsorbing agent at the surface creates distinct layers of the composition, which are identifiable, i.e., a surface layer that is enriched in the adsorbing agent and an interior layer that is depleted of that same adsorbing agent.

[0024] The surface layers (usually on both opposite surfaces of products like strips and tubes) of the product made from the adsorbent polymeric material generally form relatively well defined "migration zones", to which the adsorbing agent "migrates." Within this migration zone the maximum concentration of the adsorbing agent at a given volume unit is from 2 to 10 times, preferably 2 to 6 times, higher than its concentration in the interior or core layer of the product. The concentration of the adsorbing agent within the migration zone preferably exhibits a gradient towards the surface. The concentration of the adsorbing agent at any location within the product and the extent of the migration of the adsorbing agent may be determined by infra-red microanalysis.

[0025] It has also been surprisingly discovered that the accumulation of the adsorbing agent at a given volume unit within the migration zone is substantially greater than the accumulation at a given volume unit throughout the interior layer of the product. It is surprisingly found that the percentage of the adsorbing agent present in the migration zones of a product formed from the adsorbent polymeric material is at least about 2%, preferably at least about 4%, and most preferably at least about 6% of the overall amount of adsorbing agent present in the product, with maximum amount present being no more than about 70%, preferably no more than 50% and most preferably no more than about 40% of the overall amount of absorbing agent.

[0026] In practice it has been found that the extrusion method of manufacture of the adsorbent polymeric composition provides for more separation phenomena than does injection molding. While not wanting to be bound by any particular theory, this phenomena is probably because the extrusion process provides for more directed and constant flow of material in a single direction which results in the copolymer migrating toward the surface of the composition, taking along the adsorbent material with it. With injection molding, the composition flows in one directions but then comes into contact with the walls of the injection mold causing a back flow and partially remixing of the liquid composition. Also, injection molding of the walls of the injection mold tends to rapidly cool the outer layers of the injected thermoplastic thereby preventing strong migration of the adsorbent material to the outer layers.

[0027] By way of example, a useful multifunctional vessel may be prepared by forming an exterior shell out of a substantially impermeable thermoplastic material, such as polyethylene or polypropylene. A full or partial liner may be formed out of the scented polyolefinic material. The liner may either be formed inside the vessel in a dual injection mode or formed separately from the vessel and later inserted. The preferred method for forming the scented material is extrusion and therefore the preferred method of forming such a liner would be a separate extrusion of the liner and molding of the vessel with assembly of the two parts. Bi-injection molding is also a preferred method for the formation of this vessel.

[0028] The scent imparting material can be chosen from a large variety of aromatic or scenting materials. Generally the scent imparting materials should be oil-soluble, as oil-soluble scented substances generally dissolve in the polyolefinic material of the invention. Alternatively, scented resins may be used. Further, the substances preferably have GRAS status as recognized by the Flavoring Extract Manufactory Association. Any perfume essence, flavor or aromatic material may be incorporated into the polyolefinic material of the invention. Although not wanting to be limited, particularly suitable oils can be chosen depending upon the designated use of the vessel by the consumer, such as a lemon oil, scented oils from flowers, such as lilac, honeysuckle, rose or carnation other such oils with GRAS status, and various tobacco scented oils.

[0029] The quantity of the scenting material that can be used, can be varied depending upon the particular application. The quantity of the scenting material should be from about 0.1 wt % to 30 wt %, preferably 1 to 10 wt % by weight of the scented, shaped material.

[0030] Various manufacturing process can be utilized to produce the scented material. In one preferred embodiment, the plastic composition selected is heated to its melting temperature, wherein the scent imparting material is added. The two materials are then mixed thoroughly. The temperature of the melt should be constantly controlled during the process. The mixture of the plastic material with the scent imparting material is then directed through a plurality of orifices where the mixture is then solidified in the form of small pellets or beads. These pellets or beads form the "master pellets" which may then be admixed and liquefied with additional scented or unscented polyolefinic material, preferably unscented polyolefinic material, to produce the final polyolefinic material. In one embodiment the ratio of the master pellets to the unscented polyolefinic material is approximately 1:5 to 1:1. By this process, relatively large quantities of the scent imparting material can be added to the polyolefinic material to form an intermediate material prior to final blending of that scented plastic material master pellets with a larger quantity of the unscented plastic material. The quantity of scented plastic material that is added to the unscented plastic material can be modified depending upon the needs of the consumer. Color pigment additives and/or other additives may also be incorporated into the scented plastic material during processing.

[0031] After the blending of the unscented plastic material with the scented plastic material, the melted plastic material can be formed into any shape or design as is useful, such as in the form of canisters, strips, beads or other such shaped materials which can be placed within a multifunctional vessel. In one preferred embodiment, the scented plastic material is formed into the shape of a canister with openings therein, which can be used to hold, for example, a moisture control material and/or gas absorbing materials, such as oxygen absorbing materials. Alternatively, these canisters can be formed from an unscented plastic material and the previously discussed adsorbent polymeric composition and the scented polyolefinic material can be placed within the canisters to segregate the scented plastic material from the products placed within the multifunctional vessel. Openings are then provided in the canisters to permit the scent to permeate the vessel. Alternatively, the canisters can be formed partially or wholly from a material which is permeable to the scent contained in the scented plastic material. Conventional designs for such canisters can be utilized, such as those shown in U.S. Pat. No. 5,759,241, which is incorporated herein by reference.

[0032] In an alternative embodiment, the scented plastic material can be incorporated into an unscented plastic material using a bi-injection molding process with a conventional plastic material or with the previously discussed adsorbent polymeric composition. In this embodiment, the conventional plastic material forms the inner or outer layer of the vessel and the scented polyolefinic material forms one of the other layers of the vessel. For example, the multifunctional vessel can be formed with an outer layer of a conventional unscented, plastic material, while the inner layer is formed from the scented material.

[0033] In another preferred embodiment, a canister or other container may be placed within the multifunctional vessel, wherein the canister or other shaped material is formed by bi-injection molding with the scented polymeric material forming the outer layer of that container. By this process only a small quantity of the scented polyolefinic material need be used. In using bi-injection molding procedure, the bi-injection molded product is formed by conventional injection molding processes.

[0034] The multifunctional vessels, in addition to containing the scented material, may also contain a moisture control material. This material provides a mechanism for controlling the relative humidity in a closed environment, such as a vessel. The moisture control material can be placed within any form of container, such as a permeable canister, sachet or other plastic body which may be sealed except for a port which permits the materials contained within that plastic body to assist in the regulation of relative humidity within the multifunctional vessel. In one preferred embodiment the moisture control material is contained within a canister with openings therein. These canisters can be formed from conventional plastic materials, the scented plastic materials as discussed above or the absorbent plastic materials also discussed above. In this embodiment the moisture control material is placed within the canister to segregate the moisture control material from the products contained within the multifunctional vessel. Openings are provided in the canister to permit the moisture control material to assist in the control of moisture within the multifunctional vessel.

[0035] Moisture control material can be known materials including but not limited to bentonite clay, silica gel, montmorillonite clay, molecular sieve, calcium oxide, calcium sulfate, glycerol, sorbitol, sodium PCA, propylene glycol and mixtures thereof. The purpose of the moisture control material is to control the relative humidity within the vessel in which the moisture control material is placed. The relative humidity is controlled by the moisture control material absorbing excess moisture from the vessel when the moisture level within the vessel exceeds the desired level and/or promoting the retention of moisture inside the vessel by adding moisture to the vessel if the moisture level inside the vessel falls below the desired level.

[0036] Preferably, the air inside the multifunctional vessel is set at a desired relative humidity level at the time the moisture control material is placed within the vessel and the vessel is sealed. As the contents within the vessel are used, the relative humidity level may change depending on many factors, including how many times the vessel is opened and closed, the amount of moisture that leaks through the lid of the vessel, the permeability of the material of the vessel and the relative humidity level outside of the vessel.

[0037] The relative humidity within the vessel is controlled by the moisture control material and the relative humidity of the outside environment. The manufacturer of the vessel can attempt to control the level of the relative humidity within the vessel by choice of the particular moisture control material and by the level of water that is present in the moisture control material at the time it is placed within the vessel. A preferred range of relative humidity for the moisture control material is between 10% relative humidity and about 95% relative humidity. When the products placed within the vessel are pharmaceutical products, the relative humidity may be as low as 10%. However, when certain commercial products, such as tobacco, are present within the vessel, the relative humidity may be as high as 95%. However, in a preferred range the relative humidity is between about 20% relative humidity and 60% relative humidity.

[0038] In order for the moisture control material to maintain the relative humidity at the desired level within the vessel, it is necessary that moisture control material be introduced into the vessel at a relative humidity that assists in maintaining the level of relative humidity within the vessel. In addition, it is necessary that there be a sufficient quantity of the moisture control material present within the vessel to maintain the desired relative humidity.

[0039] In a preferred embodiment the moisture control material is hydrated prior to being introduced into the vessel. One method of hydrating the moisture control material is by placing the moisture control material in a constant humidity environment, such as a sealed room or oven, where the humidity of the environment is set within a desired relative humidity range. The moisture control material should be left in the constant humidity environment long enough for the moisture control material to become sufficiently hydrated. After the moisture control material is removed from the constant humidity environment, its moisture content can be measured or tested by well known mechanisms and instruments, such as a hygrometer, to ensure it has been sufficiently hydrated.

[0040] Once the relative humidity of the moisture control material has been determined, that relative humidity may be decreased by drying the material or increased by placing it for an additional period of time within a sealed humidity environment.

[0041] In one preferred embodiment, the moisture control material comprises silica gel. Silica gel is a porous, granular, chemically inert, amorphous form of silicon dioxide which is capable of absorbing and desorbing water vapor in order to reach equilibrium with the surrounding environment. Silica gel has a long life span and continues to absorb or desorb moisture for an extended period of time. The particular type of silica gel that is selected can be determined by the person skilled in the art reviewing the particular desired environment of the vessel.

[0042] In one preferred embodiment, the relative humidity of the silica gel is set at an appropriate relative humidity level and then placed within a container, such as a canister, and then placed within the multifunctional vessel. Along with the moisture control material, there is also present in the vessel the scented material. By the presence of these two components within the vessel, multiple functionalities are achieved including regulation of the relative humidity within the vessel and the presence of the desired scent. Further, if desired, other functionalities can be provided to the vessel including absorption of various gases, such as oxygen. All of these improvements to the multifunctional vessel assist in the preservation and maintenance of the materials present in the vessel.

[0043] It will be apparent from the forgoing that while particular forms of the invention have been illustrated various modifications can be made without departing from the scope of the invention. Accordingly, the invention is not intended to be limited by the specification of the application.

We claim:

1. A multifunctional vessel with moisture control capacity comprising

a vessel,

a scented material, comprising a plastic composition blended with a scent imparting material, wherein the scented material is present within or a component of the vessel, and

a moisture control material present within a container that is placed within the vessel.

2. The multifunctional vessel with moisture control capacity of claim 1, wherein the composition of the vessel includes an absorbent material for absorbing gases.

3. The multifunctional vessel with moisture control capacity of claim 1, wherein the scented material comprises a canister or a sachet.

4. The multifunctional vessel with moisture control capacity of claim 1, wherein the scented material comprises an inner layer of the vessel.

5. The multifunctional vessel with moisture control capacity of claim 1, wherein the scent imparting material comprises from 0.1 to about 30% by weight of the scented shape material.

6. The multifunctional vessel with moisture control capacity of claim 1, further comprising a color pigment additive.

7. The multifunctional vessel with moisture control capacity of claim 1, wherein the moisture control material comprises a hydrated material selected from the group consisting of bentonite clay, silica gel, montmorillonite clay, molecular sieve, calcium oxide, calcium sulfate, glycerol, sorbitol, propylene glycol and mixtures thereof.

8. The multifunctional vessel with moisture control capacity of claim 1, wherein the moisture control material comprises hydrated silica gel hydrated to a capacity of from 10% relative humidity to 95% relative humidity.

9. The multifunctional vessel with moisture control capacity of claim 1, wherein the moisture control material comprises hydrated silica gel and the container containing that moisture control material is selected from a canister or a sachet.

10. The multifunctional vessel with moisture control capacity of claim 1 further comprising an adsorbent polymeric composition for absorbing predetermined gases.

11. The multifunctional vessel with moisture control capacity of claim 10, wherein the adsorbent polymeric composition absorbs oxygen.

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