(12) UK Patent Application (19) GB (11) 2 230 248 (13) A

(43) Date of A publication 17.10.1990

(21) Application No 8921816.8

(22) Date of filing 27.09.1989

(30) Priority data
(31) 4597 (32) 07.04.1989 (33) KR

(71) Applicant
Doosan Farms Co Ltd

(Incorporated in the Republic of Korea)

16, 3-ka, Yangpyung-dong, Yungdungpo-ku, Seoul, Republic of Korea

(72) Inventors
Youl Lark Lee
Un Hua Pek
Don Young Suh
Ui Chan Koh

(74) Agent and/or Address for Service
J C Pedder & Co
38 Norbury Cross, Norbury, London, SW16 4JQ, United Kingdom

(51) INT CL[5]
B65D 81/24

(52) UK CL (Edition K)
B8C CWP3 C208
U1S S1074 S1449

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(58) Field of search
UK CL (Edition J) B8C CWP3
INT CL[4] B65D

(54) Method of eliminating gas in an airtight package

(57) A method of eliminating gas in an airtight package comprising enveloping absorbent or adsorbent materials capable of absorbing or adsorbing unwanted or volatile gas in a polymer film which is impermeable to liquids and solids but is permeable to gases and packing goods into an airtight container together with the enveloped absorbent or adsorbent material to eliminate the unwanted or volatile gas left in the package during the packing process or generated in or permeated into the package during storage.

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METHOD OF ELIMINATING GAS IN AN AIRTIGHT PACKAGE

The present invention relates to a method of eliminating gas in an airtight package.

In order to pack farm livestock or fishery products, processed food or chemicals, they are generally packed in airtight containers so as to prevent denaturalization of the contents. However, the airtight containers prevent not only the permeation of air and liquid materials but also the discharge of unwanted gases generated in the airtight package after it has been packed.

Particularly, when fermented or fermentable food such as "Kimchi" is packed in an airtight container, a considerable amount of carbon dioxide and other gases is generated in the airtight container during storage. The gases thus generated are not discharged and diminish or decrease the flavour and quality of the food. Also, an excessive volume of gas can damage the container due to the pressure of the gas.

Hitherto, a method of extracting unwanted material is known in which an absorbent material contained in a bag, for example, a silica gel bag, has been used. However, the silica gel bag functions merely as a moisture absorbent for absorbing moisture permeating into a package containing solid materials. This method is also useless for packaging with liquids due to the liquid permeability of the bag.

When a food package has to stand for a long period of time, it is crucial to deoxygenate the package. hitherto, antioxidants such as sodium sulphite were added to the package for deoxygenation. For

deoxygenation of a dry food, an oxygen absorbing material enveloped in a porous film was placed in the package. However, when the oxygen absorbing material is added directly, there is a safety problem. The oxygen absorbing material enveloped in a porous film also creates a safety problem because the absorbent material can escape through the porous film. This can be more significant when the package has liquid contents.

The present invention seeks to provide a method of eliminating unwanted or volatile gas left in an airtight package during the packing process or generated in or permeated into the airtight package during storage.

According to the invention, a method of eliminating gas in an airtight package comprises enveloping absorbent or adsorbent materials capable of absorbing or adsorbing unwanted or volatile gas in a polymer film which is impermeable to liquids and solids but is permeable to gases and packing goods into an airtight container together with the enveloped absorbent or adsorbent material to eliminate the unwanted or volatile gas left in the package during the packing process or generated in or permeated into the package during storage.

The invention will now be described in greater detail by way of example.

The present invention is used for eliminating unwanted or volatile gas such as oxygen (O_2), carbon dioxide (CO_2) or ammonia (NH_3) when various goods are packed into an airtight container, for example a bag, can or other conventional container. The present method is particularly applicable to the packaging of liquid foods, liquid chemicals and other goods containing liquid materials.

When an oxidizable food or chemical is packed, oxygen must be eliminated from the package. When fermentable food such as Kimchi is packed into an airtight container, it is necessary to eliminate carbon dioxide gas and/or volatile gases generated in the package during storage. Thus elimination of the unwanted or volatile gas is necessary for the preservation of the quality of the contents and prevention of damage to the container.

Therefore, the present inventions eliminates unwanted or volatile gas generated in the airtight package during the storage by using absorbent or adsorbent materials capable of absorbing or adsorbing the gas. The present invention also includes elimination of unwanted or volatile gas left in the package during the packing step or permeated into the package during storage.

The absorbent or adsorbent material used in the present invention is selected depending upon the kind of gas to be eliminated. For example, iron or sodium sulphite is used for elimination of oxygen, calcium hydroxide or sodium hydroxide is used for elimination of carbon dioxide, and active carbon is used for elimination of acetic acid. The absorbent or adsorbent material can exist in liquid or solid state. the amount of absorbent or adsorbent material used varies depending on the kind of absorbent or adsorbent material used and on the amount of gases to be eliminated.

The absorbent or adsorbent material are catalytic; they have no effect on the volume of gas.

In the present invention, the absorbent or adsorbent material is enveloped in a polymer film which is

impermeable to solids and liquids but is permeable to gases and then packed into the container. When the liquid and solid impermeable and gas permeable film is used, the solid or liquid absorbent or adsorbent material is not discharged through the film and does not contaminate the goods but gases can be eliminated due to the gas permeability of the film. In addition, some of the newly developed polymer films are selectively permeable to a specific gas. It is thus possible to eliminate only specific gases by using an appropriate film.

Polymer film is made of natural or synthetic polymers such as silicone, low density polyethylene, cellulose acetate etc., which are permeable only to specific gases to be eliminated. The present invention uses intact polymer film or a polymer film laminated or coated on paper or fabric. the polymer film comes in the form of a bag, a capsule or a carrier and is then used for enveloping the absorbent or adsorbent material.

In the present invention, the absorbent or adsorbent material enveloped in the polymer film is generally packed into a conventional airtight container such as a pouch, can or bottle. When a bottle is used as a container, the absorbent or adsorbent material enveloped in the polymer film is placed not only in the bottle but also in the bottle cap to eliminate unwanted gas in the bottle and prevent the bottle from exploding by the high pressure resulting from the generated gas.

The present invention will be illustrated in the following examples:-

Example 1

Calcium hydroxide $Ca(OH)_2$ was used as a carbon dioxide

absorbent material and a silicone film was used as the polymer film. 200g of Kimichi together with 5g of $Ca(OH)_2$ enveloped in the silicone film were placed in a container made of aluminium foil laminated with polypropylene film then the container was made airtight. It was heated to 28°C.

After 24, 40 and 60 hours, the volume of carbon dioxide gas in the container was measured. The results are shown in the table

Example 2

Following the same procedure in Example 1, but using 10ml of 8N sodium hydroxide NaOH as a carbon dioxide gas absorbent material, the results are again shown in the table.

Example 3

Following the same procedure as in Example 1, but using low density polyethylene (LDPE) film as the polymer film, the results are shown in the table.

Example 4

Following the same procedure as in Example 1 but using 10ml of 8N sodium hydroxide NaOH as a carbon dioxide gas absorbent material and LDPE film as the polymer film, the results are shown in the table.

Control

Following the same procedure as in Example 1 but using Kimchi without any absorbent material, the results are shown in the table

Table

	Absorbent Material	Polymer Film	Gas Volume (cc)		
			24hr.	40hr.	60hr.
Example 1	$Ca(OH)_2$	Silicone film	20	10	10
Example 2	NaOH	Silicone film	10	10	10
Example 3	$Ca(OH)_2$	LDPE film	30	20	10
Example 4	NaOH	LDPE film	20	10	10
Control	-	-	180	230	260

As shown in the Table, a very small amount of gas was detected in Examples 1 to 4 while a large amount of gas was detected in Control. This infers that carbon dioxide gas, generated in an airtight container during storage, was eliminated by the absorbent material enveloped in the polymer film according to the present invention. The effect of the polymer film as a gas permeable envelope was confirmed in these examples.

Example 5

90ml of water saturated with air (8ppm O_2) was poured into a 100ml glass bottle and 10ml of 20% aqueous sodium sulphite solution in a silicone bag was placed in the bottle. The bottle was rendered airtight.

After 24 hours, the amount of oxygen remaining was measured. It was found that the concentration of oxygen

was substantially decreased to 0.01ppm. The oxygen dissolved in the water had permeated the silicone bag and been absorbed by the sodium sulphite.

Example 6

100ml of 0.5% aqueous acetic acid solution was poured into a 250ml flask and 5g of active carbon enveloped in cellulose acetate film was put into the flask. The flask was made airtight.

After 50 hours, the amount of acetic acid was measured. It was found that the concentration of the acetic acid had decreased to 0.3%. The acetic acid had permeated through the cellulose film and had been adsorbed on the active carbon.

Example 7

Air saturated with sour Kimchi juice was put into a 250ml aluminium can and 0.5g of active carbon enveloped in a 0.02mm thick polyethylene film was placed in the can. The can was made airtight.

At the same time the same amount of sour Kimchi juice was poured into a 250ml flask which was then made airtight.

After 24 hours, an odour (panel) test was carried out. As compared with the absence of active carbon, the odour was significantly decreased when the active carbon was used. The volatile odorous components permeated through the polyethylene film and were adsorbed on the active carbon.

Example 8

Following the same procedure as in Example 7 but using a bottle instead of the aluminium can and placing the

active carbon in the bottle cap, the same results as in Example 7 were obtained.

As described above, the present invention can effectively eliminate unwanted or volatile gas by using absorbent or adsorbent materials enveloped in a polymer film regardless of the state of the contents, that is, liquid gas or solid, without contaminating the goods.

While the effectiveness of the present invention has been described and proved by specific experiments described in the Examples, it will be apparent to one skilled in the art that various changes and modifications can be made thereto without departing from the spirit and scope thereof.

CLAIMS

1. A method of eliminating gas in an airtight package comprising enveloping absorbent or adsorbent materials capable of absorbing or adsorbing unwanted or volatile gas in a polymer film which is impermeable to liquids and solids but is permeable to gases and packing goods into an airtight container together with the enveloped absorbent or adsorbent material to eliminate the unwanted or volatile gas left in the package during the packing process or generated in or permeated into the package during storage.

2. A method according to claim 1, wherein the gas eliminated includes a vapour volatilized from liquid goods.

3. A method according to claim 1 or 2, wherein the polymer film is an intact polymer film.

4. A method according to claim 1 or 2, wherein the polymer film is laminated or coated on paper or fabric.

5. A method according to any one of claims 1 to 4, wherein the polymer film is used in the form of a bag, capsule or in a carrier-encapsulated form.

6. A method of eliminating gas in an airtight package substantially as described herein with reference to any of the examples.

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