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LOW UNIFORM REMOVAL TORQUE GASKET-FORMING PLASTISOLS

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ABSTRACT OF THE DISCLOSURE

Plastisol gasket-forming compositions capable of providing low uniform removal torques through the use of a combination of certain lubricants including stearyl alcohol and silicon, and the gaskets so formed.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to plastisol gasket-forming compositions capable of providing low uniform removal torques for easy disengagement of a gasketed lid from a container.

Discussion of the prior art

Plastisols are widely used in forming sealing gaskets for containers. The plastisol gaskets are formed on lids to provide a seal between the lid and a container. To place a plastisol gasket on a lid, the plastisol composition is deposited, e.g., as a liquid ring, at the appropriate portion on the lid and then heated to flux the resin and plasticizer. When cooled, the resulting plastisol gasket adheres to the lid as a resilient solid which serves as a highly desirable sealing gasket.

More recent innovation has provided the container industry with twist-off lids for more convenient access to the food or beverage stored within the container. Understandably, the twist-off lid must be easily removable. Thus, sealing compositions designed particularly for twist-off lids provide easy removability as well as excellent sealability.

To provide easy removability, as in a twist-off lid, it is necessary to add lubricants to a given plastisol composition. However, most lubricant systems provide removal torques which vary with changes in the temperature to which the sealed container is exposed and which vary with the amount of time the container is stored.

Temperature variations occur in the process of filling and sealing a container. Most importantly, however, temperature variations occur in the actual formation of the gasket in the closure. The temperatures used help determine the final characteristics of a plastisol gasket, the characteristics being dependent on the substance to be sealed in a container. To provide low uniform removal torques, it is necessary that a lubrication system be unaffected by temperature variations due to different process requirements and food packing temperatures.

Storage times also affect removal torques since certain chemical changes in the plastisol gasket can occur over periods of time. To provide low uniform removal torques, it is necessary that a lubrication system be unaffected by long periods of storage.

Therefore, a plastisol gasket with a lubrication system providing low uniform removal torques through varying temperatures and storage times while maintaining excellent sealability characteristics is the ideal.

SUMMARY OF THE INVENTION

This invention resides in a lubrication system for a plastisol gasket composition which provides lids containing the gasket composition with low uniform removal torques over varying temperatures and storage times.

It is therefore an object of this invention to provide an improved plastisol gasket composition with a lubrication system that gives low uniform removal torques.

It is another object of this invention to provide an improved plastisol gasket composition with a lubrication system that gives low uniform removal torques over varying temperatures and storage times.

It is a further object of this invention to provide a lid, with a plastisol gasket composition, that is easily removable from its container over various temperatures and storage times while providing an excellent seal for the container.

These and other objects and advantages will become apparent from the following description and example which are intended only as illustration and should in no way limit the invention.

DETAILED DESCRIPTION OF THE INVENTION

The gasket compositions of this invention generally comprise a plastisol mixture of a resin, plasticizers, stabilizers and stearyl alcohol and silicon.

The polyvinyl chloride resins of the plastisol gasket composition disclosed herein are formed by emulsion or suspension polymerization techniques and then spray dried. Emulsion and suspension polymerization produce dense spherical particles having a diameter in the order of about 1 to 10 microns. Polyvinyl chloride resins are easily dispersible as particles in plasticizers but are not dissolved thereby until the temperature reaches about 300° F. to 400° F. Many polyvinyl chlorides are used in commercial practice and are suitable for use herein. For example, Geon 128 and Geon 202 polyvinyl chloride resins, produced by B. F. Goodrich Chemical Company, can be advantageously used in the compositions disclosed herein. These polyvinyl chloride resins have an inherent viscosity of about 0.86 to 1.20 and a specific gravity of about 1.4. Plastisol gasket compositions of this invention are based on the use of about 100 parts of a polyvinyl chloride resin, preferably of about 50 to 100 parts polyvinyl chloride resin having an inherent viscosity of about 1.20 and a specific gravity of about 1.40 and about 0 to 50 parts of a polyvinyl chloride resin having an inherent viscosity of about 0.85 and a specific gravity of about 1.41, are used in the compositions of this invention. Most preferably, about 60 parts of a polyvinyl chloride resin having an inherent viscosity of about 1.20 and a specific gravity of about 1.40 and about 40 parts polyvinyl chloride resin having an inherent viscosity of about 0.85 and a specific gravity of about 1.41 are used in the compositions of this invention.

The plasticizer contemplated for use in the compositions disclosed herein is di-2-ethylhexyl phthalate although other plasticizers would be suitable. The plasticizer is partially mixed with stearyl alcohol. An example of a di-2-ethylhexyl phthalate is that which is produced by Eastman Chemical Products which has a boling point of about 384° F. Advantageously, about 50 to 100 parts di-2-ethylhexyl phthalate plasticizer and about 4 to 6 parts of stearyl alcohol are provided the compositions disclosed herein. Most advantageously, about 75 parts di-2-ethylhexyl phthalate is provided the plastisol compositions disclosed herein with about 5 parts stearyl alcohol.

About 10 to 100 parts of a dry ground barium sulphate is provided the compositions disclosed herein. Preferably, about 35 to 65 parts dry ground barium sulphate and most preferably about 45 parts dry ground barium sulphate is provided the compositions disclosed herein.

In addition to stearyl alcohol, about 3 to 8 parts silicon or dimethylpolysiloxane having a specific gravity at 25° C. of about 0.97 and a flash point of about 600° F. is use-

ful to the compositions disclosed herein. An example of dimethylpolysiloxane is that produced by Union Carbide named L–45 Silicon Fluid. Most preferably, about 5 parts dimethylpolysiloxane is provided the compositions disclosed herein.

In addition, about 1 to 3 parts calcium zinc epoxy stabilizer is provided the compositions disclosed herein. An example of calcium zinc epoxy stabilizer that can be used herein is that produced by Ferro Chemical named Ferro 707–X. Preferaby, about 1 part calcium zinc epoxy stabilizer is provided the compositions disclosed herein.

Other conventional additives may be used in the plastisol compositions disclosed herein, e.g., pigments, fillers and blowing agents, without altering the compositions' performance as sealants or the compositions' low uniform removal torque characteristics.

Fillers including clays, charcoals and silicas, e.g., Cab-O-Sil M–5 silica, can be used herein. For example, Cab-O-Sil M–5 silica is useful in amounts of about 0 to 3 parts with about 0.25 part being preferable based upon the use of 100 parts polyvinyl chloride resin. The silica exemplified above has an average particle size of about 0.015 micron and a specific gravity of about 2.2.

Pigments are well-known, a typical example being titanium dioxide. Advantageously, about 0 to 8 parts titanium dioxide may be provided the compositions disclosed herein, 5 parts being most preferable based on the use of 100 parts polyvinyl chloride resin.

Blowing agents are also well-known, a typical example being azobisformamide. Kempore SDS–200, produced by National Polychemicals, is an example of azobisformamide advantageously provided the compositions disclosed herein. The exemplified azobisformamide has a specific gravity of about 1.18 and is dispersed in ester plasticizer containing 33% azobisformamide. About 0 to 4 parts azobisformamide may be provided compositions diclosed herein, 1.25 parts being most preferable based on the use of 100 parts polyvinyl chloride resin.

The following example illustrates the low uniform removal torques provided the compositions disclosed herein over varying temperatures and storage times. All components are in parts by weight, unless otherwise noted.

EXAMPLE

Composition	A	B	C	D	E
100 parts polyvinyl chloride resin	X	X	X	X	X
75 parts di-2-ethylhexyl phthalate	X	X	X	X	X
50 parts dry ground barium sulfate	X	X	X	X	X
5 parts dimethylpolysiloxane	X	X	X	X	X
1 part calcium zinc epoxy stabilizer	X	X	X	X	X
5 parts straight chain hydrocarbon wax	X	-------	-------	-------	-------
5 parts C_{12}–C_{18} fatty alcohol esters	-------	X	-------	-------	-------
2.5 parts stearyl alcohol	-------	-------	X	-------	-------
2.5 parts C_{12}–C_{18} fatty alcohol esters	-------	-------	X	-------	-------
5 parts paraffin lubricant	-------	-------	-------	X	-------
5 parts stearyl alcohol	-------	-------	-------	-------	X
Removal torques:					
3 days storage	40.1	37.0	37.2	38.8	35.0
Room Temperature	37–42	35–40	35–38	37–40	33–37
5 weeks storage	40.5	37.3	39.8	39.5	34.8
Room temperature	38–43	36–38	38–43	37–43	33–36
1 day storage	56.0	53.0	54.7	54.3	48.3
Refrigerated	55–58	52–55	52–57	53–55	45–48

With significant modifications made only in the lubrication system, it is clearly shown that Composition E, a composition of this invention, has low uniform removal torques when compared with Compositions A through D. For example, Composition A has removal torques ranging from 37 to 58 inch pounds compared with Composition E having removal torques ranging only from 33 to 48 inch pounds, both compositions being stored for various equal lengths of time at varying temperatures.

As will be evident to those skilled in the art, various modifications which are to be included as part of this invention can be made in the light of the foregoing disclosure without parting from the spirit thereof.

What is claimed is:

1. A gasket-forming composition capable of producing a gasket having low uniform removal torques, comprising:
(a) about 50 to 100 parts of di-2-ethylhexyl phthalate plasticizer;
(b) about 4 to 6 parts stearyl alcohol;
(c) about 100 parts polyvinyl chloride resins dispersed in said plasticizer, said resin having an inherent viscosity of about 0.86 to 1.20 and a specific gravity of about 1.4;
(d) about 3 to 8 parts dry ground barium sulphate;
(e) about 10 to 100 parts dimethylpolysiloxane, said dimethylpolysiloxane having a specific gravity at 25° C., of about 0.97 and a flash point of about 600° F.; and
(f) about 1 to 3 parts calcium zinc epoxy stabilizer.

2. The composition of claim **1** having about 5 parts stearyl alcohol.

3. The composition of claim **2** having about 5 parts dimethylpolysiloxane.

4. The composition of claim **3** including from about 0 to 8 parts titanium dioxide.

5. The composition of claim **4** having from about 0 to 4 parts of an azobisformamide dispersion in the said plasticizer, said azobisformamide being present in an amount of about 33% of said dispersion.

6. The composition of claim **5** having from about 0 to 3 parts silica.

7. A gasket-forming composition capable of producing a gasket having low uniform removal torques, comprising:
(a) about 50 to 100 of di-2-ethylhexyl phthalate plasticizer;
(b) about 5 parts stearyl alcohol;
(c) about 100 parts polyvinyl chloride resin mixture dispersed in said plasticizer, said mixture being of from about 50 to 100 parts polyvinyl chloride resin having an inherent viscosity of about 1.20 and a specific gravity of about 1.40 and from about 0 to 50 parts polyvinyl chloride resin having an inherent viscosity of about 0.85 and a specific gravity of about 1.41;
(d) about 15 to 65 parts dry ground barium sulphate;
(e) about 3 to 8 parts dimethylpolysiloxane, said dimethylpolysiloxane having a specific gravity at 25° C., of about 0.97 and a flash point of about 600° F.; and
(f) about 1 to 3 parts calcium zinc epoxy stabilizer.

8. The composition of claim **7** having about 5 parts dimethylpolysiloxane.

9. The composition of claim **8** having about 0 to 8 parts titanium dioxide.

10. The composition of claim **9** having from about 0 to 4 parts of an azobisformamide dispersion in the said plasticizer, said azobisformamide being present in an amount of about 33% of said dispersion.

11. The composition of claim **10** having from about 0 to 3 parts silica having an average particle size of about 0.015 micron and a specific gravity of about 2.2.

12. A gasket-forming composition capable of producing a gasket having low uniform removal torques, comprising:
(a) about 80 parts of di-2-ethylhexyl phthalate plasticizer;
(b) about 5 parts stearyl alcohol;
(c) about 100 parts polyvinyl chloride resin mixture dispersed in said plasticizer, said mixture being of about 60 parts polyvinyl chloride resin having an inherent viscosity of about 1.20 and a specific gravity of about 1.40 and about 40 parts polyvinyl chloride resin having an inherent viscosity of about 0.85 and a specific gravity of about 1.41;

(d) about 45 parts dry ground barium sulphate;

(e) about 3 to 8 parts dimethylpolysiloxane, said dimethylpolysiloxane having a specific gravity at 25° C., of about 0.97 and a flsh point of about 600° F.; and

(f) about 1 part calcium zinc epoxy stabilizer.

13. The composition of claim **12** having about 5 parts dimethylpolysiloxane.

14. The composition of claim **13** having about 5 parts titanium dioxide.

15. The composition of claim **14** having about 1.25 parts of an azobisformamide dispersion in the said plasticizer, said azobisformamide being present in an amount of about 33% of said dispersion.

16. The composition of claim **15** having about 0.25 part silica having an average particle size of about 0.015 micron and a specific gravity of about 2.2.

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