

EXTRUDABLE VINYLIDENE CHLORIDE POLYMER COMPOSITIONS

This invention relates to vinylidene chloride polymer (PVDC) compositions having improved extrudability.

To control the generation of PVDC degradation products during melt-processing, processing aids such as lubricants (for example, internal and external types), olefinic waxes and oils have been blended with the vinylidene chloride polymer prior to fabrication into a final product. However, it has been found that, after prolonged periods of extrusion under desirable processing conditions, an excessive degree of adhesion develops between the vinylidene chloride polymer and the metal surfaces of the extruder screw and die. This adhesion increases the residence time of the vinylidene chloride polymer which promotes degradation, resulting in the formation of die face buildup or die slough generation, and in the generation of carbon buildup on the screw and die metal surfaces.

It would be desirable to provide a vinylidene chloride polymer composition which is capable of being extruded, in either powder or pellet form, without having an unacceptable level of degradation which results from excessive adhesion between the PVDC melt and the screw and die metal surfaces.

In a first aspect, the present invention is a vinylidene chloride polymer (PVDC) composition comprising (1) a vinylidene chloride polymer, (2) a glycerol ester and (3) a silicone polymer, the glycerol ester and silicone polymer being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer.

In a second aspect, the present invention is a vinylidene chloride polymer (PVDC) composition comprising (1) a vinylidene chloride polymer, (2) a glycerol ester, (3) a silicone polymer and (4) an epoxidized processing aid, the glycerol ester, silicone polymer and epoxidized processing aid being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer.

In a third aspect, the present invention is a vinylidene chloride polymer (PVDC) composition comprising (1) a vinylidene chloride polymer, (2) a glycerol ester and (3) a polyolefin, the glycerol ester, and polyolefin being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer.

The inventors have discovered that adding a glycerol ester and a silicone polymer or a polyolefin and, optionally, an epoxidized processing aid to PVDC improves the

extrudability of the PVDC by reducing its degree of adhesion to the metal surfaces of the screw and die. The PVDC compositions of the present invention are considered to possess improved extrudability. As used herein, the term "improved extrudability" means that, if subjected to desirable processing conditions in an extruder, the polymer composition is less thermally sensitive and, consequently, the extrudate possesses a reduced level of degraded material in the form of die face buildup, slough generation and carbon buildup on extruder screw and die surfaces, reduced discoloration or less hydrogen chloride evolution and a lower mechanical energy to extrude, that is, amount of energy expended to extrude the polymer due to friction and the viscosity of the polymeric composition, than a PVDC composition which does not contain the silicone/carrier polymer concentrate.

Vinylidene chloride polymers which can be employed in the practice of the present invention are well-known in the art. See, for example, U.S. Patents 3,642,743 and 3,879,359. The most common PVDC resins are known as Saran™ resins, manufactured by The Dow Chemical Company. As used herein, the term "vinylidene chloride polymer" or "PVDC" encompasses homopolymers of vinylidene chloride, and also copolymers and terpolymers thereof, wherein the major component is vinylidene chloride and the remainder is one or more monoethylenically unsaturated monomer copolymerizable with the vinylidene chloride monomer. Monoethylenically unsaturated monomers which can be employed in the practice of the present invention for preparing the vinylidene chloride polymers include vinyl chloride, alkyl acrylates, alkyl methacrylates, acrylic acid, methacrylic acid, itaconic acid, acrylonitrile, and methacrylonitrile. Preferred ethylenically unsaturated monomers include vinyl chloride, acrylonitrile, methacrylonitrile, alkyl acrylates, and alkyl methacrylates. More preferred ethylenically unsaturated monomers include vinyl chloride, acrylonitrile, methacrylonitrile, and the alkyl acrylates and alkyl methacrylates having from 1 to 8 carbon atoms per alkyl group. Most preferred ethylenically unsaturated monomers are vinyl chloride, methylacrylate, ethylacrylate, and methyl methacrylate.

Preferably, the vinylidene chloride polymer is formed from a monomer mixture comprising a vinylidene chloride monomer generally in the range of from 60 to 99 weight percent and the monoethylenically unsaturated comonomer in an amount of from 40 to 1 weight percent, said weight percents being based on total weight of the vinylidene chloride interpolymers. More preferably, the amount of monoethylenically unsaturated monomer is from 40 to 4 weight percent, and most preferably, from 40 to 6 weight percent, based on total weight of the vinylidene chloride polymer.

The glycerol esters which can be employed in the practice of the present invention for preparing the vinylidene chloride polymer composition are those having from 14 to 22 carbon atoms, such as, for example, glycerol monostearate, glycerol monopalmitate, glycerol monooleate, glycerol monolinooleate, glycerol monolinolenate and their corresponding di- and triesters. The preferred glycerol ester is glycerol monostearate.

The amount of glycerol ester which can be employed in the present invention depends on the composition of the vinylidene chloride polymer composition and the processing conditions to which the vinylidene chloride polymer composition is exposed, but in general, the amount is from 0.05 to 10, preferably from 0.2 to 5 and most preferably 2 weight percent, based on the weight of the vinylidene chloride polymer composition.

The silicone polymers which can be employed in the practice of the present invention for preparing the vinylidene chloride composition include the high viscosity silicone fluids. The term "high viscosity silicone fluids" as used herein is intended to represent a wide range of polysiloxane materials having a high molecular weight. These high viscosity silicone fluids, often characterized as silicone gums, are comprised of 20 to 100 percent siloxane polymers having an average molecular weight of 50,000 or above and provide a viscosity of 90,000 centipoise and above at ambient temperature. The preferred polysiloxanes are polydimethyl siloxane, polydimethyldiphenyl siloxane and polymethyl alkyl aryl siloxane. It is known that these fluids are difficult to handle and feed into conventional blending equipment with solid thermoplastic polymers due to their high viscosity. See, for example, U.S. Patent 4,446,090.

The high viscosity silicone fluids are employed in the practice of the present invention in the form of concentrates. The silicone polymer concentrate can be prepared by blending the high viscosity silicone polymer and a carrier polymer (for example HDPE) in the melt using conventional melt-processing techniques. Conventional melt-processing equipment which may be used includes heated two-roll compounding mills, Brabender mixers, Banbury mixers, single screw extruders, and twin screw extruders. It is desirable that the silicone polymer and carrier polymer be blended under conditions and for a time sufficient to produce a visually homogeneous blend of the silicone polymer and carrier polymer.

The amount of silicone polymer employed in the practice of the present invention for preparing the concentrate is from 0.1 to 99.9, preferably from 10 to 90 and, most preferably, from 25 to 75 weight percent, based on the weight of the concentrate.

The carrier polymers which can be employed in the practice of the present invention for preparing the concentrate are those which are known in the art for imparting beneficial properties to vinylidene chloride polymers, such as, for example, polyolefins, oxidized polyolefins, ethylene vinyl acetate copolymers, and acrylate copolymers. Preferably, the carrier polymer is a polyolefin, more preferably, a polyethylene and, most preferably, a high density polyethylene (HDPE).

The amount of carrier polymer employed in the practice of the present invention for preparing the concentrate is from 0.1 to 99.9, preferably from 10 to 90 and, most preferably, from 25 to 75 weight percent, based on the weight of the concentrate.

The most preferred silicone/carrier polymer concentrate is commercially available from Dow Corning as a 50/50 weight percent blend of a high viscosity, high molecular weight polydimethyl siloxane and HDPE.

The silicone/carrier polymer concentrate of the present invention is typically blended with the vinylidene chloride polymer in an amount sufficient to provide from 0.01 to 10 weight percent silicone/carrier polymer concentrate in the blend.

Other types of silicone polymers which can be employed in the present invention include low viscosity silicone fluids, such as those having a viscosity of at least about 100 centipoise at 25°C.

The amount of silicone polymer present in the vinylidene chloride polymer composition of the present invention depends on the composition of the vinylidene chloride polymer composition and the processing conditions to which the vinylidene chloride polymer composition is exposed. In general, the amount of silicone polymer present in the vinylidene chloride polymer composition is from 0.005 to 5.0, preferably from 0.02 to 0.2 and most preferably 0.1 weight percent, based on the weight of the vinylidene chloride polymer composition.

The epoxidized processing aids which can be used in the practice of the present invention for preparing the vinylidene chloride polymer composition include the

epoxidized vegetable oils, such as linseed oil, soybean oil, coconut oil, safflower oil, sunflower oil, and cotton seed oil; and the epoxidized fatty acid monoesters, such as, octyl stearate; and epoxidized diesters, such as the glycol ester of an unsaturated fatty acid, such as glycol dioleate.

5 The amount of epoxidized stabilizer which can be employed in the present invention depends on the composition of the vinylidene chloride polymer composition and the processing conditions to which the vinylidene chloride polymer composition is exposed, but in general, the amount is from 0.1 to 10, preferably from 0.4 to 4 and most preferably 1 weight percent, based on the weight of the vinylidene chloride polymer composition.

10 A variety of conventional additives may also be incorporated into the vinylidene chloride polymer composition. Additive type and amount will depend upon several factors. One factor is the intended use of the composition. A second factor is tolerance of the composition for the additives. That is, how much additive can be added before physical properties of the blends are adversely affected to an unacceptable level. Other factors are
15 apparent to those expert in the art of polymer formulation and compounding.

 Exemplary additives include plasticizers, heat stabilizers, pigments, processing aids, lubricants, fillers, and antioxidants. Each of these additives is known and several types of each are commercially available.

 Exemplary lubricants include fatty acids, such as stearic acid; esters, such as
20 fatty esters, wax esters, glycol esters, and fatty alcohol esters; fatty alcohols, such as n-stearyl alcohol; fatty amides, such as N,N'-ethylene bis stearamide; metallic salt of fatty acids, such as calcium stearate, zinc stearate, magnesium stearate; and polyolefin waxes, such as paraffinic, and oxidized polyethylene. Paraffin and polyethylene waxes and their properties and synthesis are described in 24 Kirk-Othmer Encyc. Chem. Tech. 3rd Ed.,
25 Waxes, at 473-77 (J. Wiley & Sons 1980).

 The additives may be incorporated into the vinylidene chloride polymer composition by using conventional melt-processing, as well as dry blending techniques for thermally sensitive polymers. The vinylidene chloride polymer composition of the present invention can be melt-processed and extruded into any suitable final product, for example, a
30 variety of films or other articles. As is well known in the art, the films and articles are fabricated with conventional coextrusion; for example, feedblock coextrusion, multimanifold

die coextrusion, or combinations of the two; injection molding; co-injection molding; extrusion molding; casting; blowing; blow molding; calendering; and laminating.

Exemplary articles include blown and cast, mono and multilayer, films; rigid and flexible containers; rigid and foam sheet; tubes; pipes; rods; fibers; and various profiles.

5 Lamination techniques are particularly suited to produce multi-ply sheets. As is known in the art, specific laminating techniques include fusion; that is, whereby self-sustaining lamina are bonded together by applications of heat and pressure; wet-combining, that is, whereby two or more plies are laminated using a tie-coat adhesive, which is applied wet, the liquid driven off, and in one continuous process combining the plies by subsequent pressure lamination; 10 or by heat reactivation, that is, combining a precoated film with another film by heating, and reactivating the precoat adhesive so that it becomes receptive to bonding after subsequent pressure laminating.

The vinylidene chloride polymer compositions of the present invention are particularly suited for fabrication into flexible and rigid containers both in monolayer and 15 multilayer structures used for the preservation of food, drink, medicine and other perishables. Such containers should have good mechanical properties, as well as low gas permeabilities too, for example, oxygen, carbon dioxide, water vapor, odor bodies or flavor bodies, hydrocarbons or agricultural chemicals.

The monolayer structures comprise the vinylidene chloride polymer 20 composition of the present invention.

The multilayer structure comprises (1) one or more layers of an organic polymer or a blend of two or more different organic polymers, the organic polymer of one layer being the same as or different from the organic polymer of another layer and (2) one or more layers of the vinylidene chloride polymer composition of the present invention.

25 The multilayer structure can have three layers comprising (1) a first outer layer of the organic polymer or blend of two or more different organic polymers, (2) a core layer of the vinylidene chloride polymer composition of the present invention and (3) a second outer layer of an organic polymer which is the same as or different from the organic polymer of the first outer layer.

30 The multilayer structure can also have five or seven layers comprising one or more layers of the vinylidene chloride polymer composition of the present invention, and the

remaining layers comprising an organic polymer or a blend of two or more different organic polymers, the organic polymer of one layer being the same as or different from the organic polymer of another layer.

5 Adhesive layers may be interposed between contiguous layers of the multilayer structures, depending on the composition and method of preparing the multilayer structure.

Organic polymers which can be used in the practice of the present invention for preparing the multilayer structure include polyolefins, polyamides, polymers based on aromatic monomers, and chlorinated polyolefins.

10 By the term "polyolefin" is meant a polymer or copolymer of ethylene, that is, a polymer derived solely from ethylene, or ethylene and one or more monomers copolymerizable therewith. Such polymers (including raw materials, their proportions, polymerization temperatures, catalysts and other conditions) are well-known in the art and reference is made thereto for the purpose of this invention. Additional comonomers which
15 can be polymerized with ethylene include olefin monomers having from 3 to 12 carbon atoms, ethylenically unsaturated carboxylic acids (both mono- and difunctional) and derivatives of such acids such as esters (for example, alkyl acrylates) and anhydrides; monovinylidene aromatics and monovinylidene aromatics substituted with a moiety other than halogen such as styrene and methylstyrene; and carbon monoxide. Exemplary
20 monomers which can be polymerized with ethylene include 1-octene, acrylic acid, methacrylic acid, vinyl acetate and maleic anhydride.

Polyolefins which can be employed in the practice of the present invention for preparing the multilayer laminate structure include polypropylene, polyethylene, and copolymers and blends thereof, as well as ethylene-propylene-diene terpolymers. Preferred
25 polyolefins are polypropylene, linear high density polyethylene (HDPE), heterogeneously-branched linear low density polyethylene (LLDPE) such as DOWLEX™ polyethylene resin (a trademark of The Dow Chemical Company), heterogeneously-branched ultra low linear density polyethylene (ULDPE) such as ATTANE™ ULDPE (a trademark of The Dow Chemical Company); homogeneously-branched, linear ethylene/ α -olefin copolymers such as
30 TAFMER™ (a trademark of Mitsui Petrochemicals Company Limited) and EXACT™ (a trademark of Exxon Chemical Company); homogeneously-branched, substantially linear ethylene/ α -olefin polymers such as AFFINITY™ (a trademark of The Dow Chemical

Company) and ENGAGE® a trademark of DuPont Dow Elastomers of polyolefin elastomers, which can be prepared as disclosed in U.S. Patents 5,272,236 and 5,278,272; and high pressure, free radical polymerized ethylene polymers and copolymers such as low density polyethylene (LDPE), ethylene-acrylic acid (EAA) copolymers such as PRIMACOR™ (trademark of The Dow Chemical Company), and ethylene-vinyl acetate (EVA) copolymers such as ESCORENE™ polymers (a trademark of Exxon Chemical Company), and ELVAX™ (a trademark of E.I. DuPont de Nemours & Co.). The more preferred polyolefins are the homogeneously-branched linear and substantially linear ethylene copolymers with a density (measured in accordance with ASTM D-792) of 0.85 to 0.99 g/cm³, a weight average molecular weight to number average molecular weight ratio (M_w/M_n) from 1.5 to 3.0, a measured melt index (measured in accordance with ASTM D-1238 (190/2.16)) of 0.01 to 100 g/10 minutes, and an I10/I2 of 6 to 20 (measured in accordance with ASTM D-1238 (190/10)).

In general, high density polyethylene (HDPE) has a density of at least about 0.94 grams per cubic centimeter (g/cc) (ASTM Test Method D-1505). HDPE is commonly produced using techniques similar to the preparation of linear low density polyethylenes. Such techniques are described in U.S. Patents 2,825,721; 2,993,876; 3,250,825 and 4,204,050. The preferred HDPE employed in the practice of the present invention has a density of from 0.94 to 0.99 g/cc and a melt index of from 0.01 to 35 grams per 10 minutes as determined by ASTM Test Method D-1238.

Polymers based on aromatic monomers which can be employed in the practice of the present invention include polystyrene, polymethylstyrene, polyethylstyrene, styrene/methylstyrene copolymer, and styrene/chlorostyrene copolymer.

Polyamides which can be employed in the practice of the present invention include the various grades of nylon, such as nylon-6, nylon-66 and nylon 12.

Adhesive materials which can be employed in the practice of the present invention for preparing the adhesive layer include ethylene vinyl acetate copolymers, ethylene/ethyl acrylic acid ester copolymers, ionomers, modified polyolefins as described in U.S. Patent 5,443,874, acrylic-based terpolymer adhesives as described in U.S. Patent 3,753,769 and adhesives formed by reacting an epoxy resin and an acidified aminoethylated vinyl polymer as described in U.S. Patent 4,447,494. The more preferred adhesive materials are maleic anhydride grafted polyethylene or polypropylene such as ADMER (trademark of

Mitsui Petrochemicals) adhesive resins, or ethylene-vinyl acetate copolymer resins such as ELVAX™ (trademark of DuPont). The most preferred adhesive material is ELVAX™ 3175, which is a 6 Melt Index, 28 percent vinyl acetate copolymer. The thickness of the monolayer and multilayer structures of the present invention is variable within wide limits, depending on

5 the contemplated application. In general, the monolayer structure of the present invention has a thickness of from 0.05 to 10 mils, preferably, from 0.2 to 6 mils, most preferably, from 0.4 to 1.8 mils. In general, the multilayer structure of the present invention has a thickness of from 0.05 to 200 mils, preferably from 1 to 100 mils, most preferably, from 2 to 80 mils, with the PVDC polymer layer having a thickness of from 0.005 to 20 mils, preferably from 0.2

10 to 10 mils, most preferably, from 0.2 to 8.0 mils.

The present invention is illustrated in further detail by the following examples. The examples are for the purposes of illustration only, and are not to be construed as limiting the scope of the present invention. All parts and percentages are by weight unless otherwise specifically noted.

15 Examples 1-3 and Comparative Examples A and B

The following formulations of a vinylidene chloride copolymer (7.75 weight percent methyl acrylate, 92.25 weight percent vinylidene chloride) prepared using a conventional high intensity blender were employed in the examples:

Example 1

20	Vinylidene chloride copolymer	95.27 wt.
	Epoxidized soybean oil	1.2 wt. %
	Glycerol monostearate	2.0 wt. %
	Oxidized polyethylene wax	0.18 wt. %
	Polyethylene wax	0.45 wt. %
25	High density polyethylene	0.90 wt. %

Example 2

	Vinylidene chloride copolymer	96.475 wt. %
	Epoxidized soybean oil	1.0 wt. %
	Glycerol monostearate	2.0 wt. %
5	Oxidized PE wax	0.1 wt. %
	Polyethylene wax	0.1 wt. %
	High Mw silicone/HDPE conc.	0.125 wt. %

Comparative Example A

	Vinylidene chloride copolymer	96.27 wt. %
10	Epoxidized soybean oil	2.2 wt. %
	Oxidized PE Wax	0.18 wt. %
	PE wax	0.45 wt. %
	HDPE	0.90 wt. %

Comparative Example B

15	Vinylidene chloride copolymer	96.8 wt. %
	Epoxidized soybean oil	1.2 wt. %
	Glycerol Monostearate	2.0 wt. %

Extrusion Conditions:

9 hour trials, started with a clean system (screw, barrel, and die).

20 Rate: 42 lb/hr, 17 RPM, 2.5-inch diameter 21:1 L/D Extruder, monolayer cross-head die.

Barrel Temperatures: 150°C (feed), 155°C (transition), 160°C (meter).

Die temperature: 173°C, Nosepiece: 175°C, Adaptor: 175°C, Feedthroat: 38°C.

Extrusion trials were conducted on clean equipment, and the PVDC formulations extruded for 9 hours each. At the end of the 9 hours, the screw was stopped, and full cooling put on the barrel and die. This froze the polymer in the die without additional degradation. The die was then dis-assembled, and the carbon tended to stick to the polymer when removed from the die. This allowed for a method to compare carbon generation between different PVDC copolymer formulations. The Comparative Example A formulation when extruded for 9 hours gave an outer portion of the die that was totally covered with black carbon. When Examples 1 and 2 formulations were extruded for 9 hours, they both gave an outer surface that was totally clean of carbon. The extrusion trial with the Comparative Example B formulation was stopped after 2 hours because of poor quality film due to heavy die lines, slough, and a rough surface to the film. This indicates that the external lubricants (for example, oxidized PE wax, PE wax, HDPE, silicone concentrate) are necessary in combination with the GMS.

Barrier Testing

Barrier properties were determined for monolayer blown films (1 to 2 mil) at 23°C and 60 percent relative humidity in accordance with ASTM Method D-3985-81. The barrier property of the film formed from the Example 1 formulation (0.085 cc-mil/100 in²-atm-day) was superior compared to that of the Comparative Example A formulation (0.11 cc-mil/100 in²-atm-day). This improvement in barrier is highly desirable. It is surprising that barrier properties and processing are both improved, because usually, an improvement in processability results in a detrimental effect on barrier properties. This is due to the fact that the improved stability of the GMS-containing formulation was obtained at a reduced ESO level (2.0 percent vs. 1.0 percent). It is known that liquid stabilizers have a detrimental effect on barrier properties.

Thermal Stability

Two-roll mill testing was also performed to compare thermal stability of PVDC copolymer formulations. In this test, 200 g of blended PVDC copolymer was placed on two heated, co-rotating rolls. The polymer then melted due to the heat and shear created within the sample. The time to significant degradation was compared between samples. Testing was done at 180°C roll temperature. The Comparative Example A formulation evolved small HCL bubbles after 11 minutes. The Example 1 formulation took 13.5 minutes to reach the

same level of gassing. This is a further indication of the improved thermal stability provided by the GMS-containing formulation.

**CLAIMS:**

1. A vinylidene chloride polymer composition comprising (1) a vinylidene chloride polymer wherein the major component is a vinylidene chloride monomer and the remainder is one or more monoethylenically unsaturated monomer copolymerizable with the vinylidene chloride monomer, 2) a glycerol ester and (3) a silicone polymer, the glycerol ester and silicone polymer being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer, and, optionally, an epoxidized processing aid.
2. The composition of Claim 1 wherein the vinylidene chloride polymer is formed from a monomer mixture comprising from 60 to 99 weight percent vinylidene chloride monomer and from 40 to 1 weight percent of a monoethylenically unsaturated comonomer copolymerizable therewith.
3. The composition of Claim 2 wherein the monoethylenically unsaturated monomer is vinyl chloride, alkyl acrylate, alkyl methacrylate, acrylic acid, methacrylic acid, itaconic acid, acrylonitrile, or methacrylonitrile.
4. The composition of Claim 1 wherein the glycerol ester is glycerol monostearate, glycerol monopalmitate, glycerol monooleate, or the diester or triester thereof.
5. The composition of Claim 1 wherein the glycerol ester is present in an amount of from 0.05 to 10 weight percent, based on the weight of the composition.
6. The composition of Claim 1 wherein the silicone polymer is polydimethyl siloxane, polydimethyldiphenyl siloxane or polymethyl alkyl aryl siloxane.
7. The composition of Claim 1 wherein the silicone polymer is present in an amount of from 0.001 to 5 weight percent, based on the weight of the composition.
8. The composition of Claim 1 wherein the silicone polymer is in the form of a concentrate comprising a carrier polymer.
9. The composition of Claim 8 wherein the carrier polymer is a polyolefin, an oxidized polyolefin, an ethylene vinyl acetate copolymer, or an acrylate copolymer.
10. The composition of Claim 1 wherein the epoxidized processing aid is an epoxidized vegetable oil, epoxidized fatty acid monoester or epoxidized diester.





11. The composition of Claim 10 wherein the epoxidized processing aid is linseed oil, soybean oil, coconut oil, safflower oil, sunflower oil, cotton seed oil, or octyl stearate.

12. A vinylidene chloride polymer composition comprising (1) a vinylidene chloride polymer wherein the major component is vinylidene chloride monomer and the remainder is one or more monoethylenically unsaturated monomer copolymerizable with the vinylidene chloride monomer, (2) a glycerol ester and (3) a polyolefin, the glycerol ester and polyolefin being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer.

13. The composition of Claim 12 wherein the polyolefin is a high density polyethylene, a polyethylene wax, an oxidized polyethylene wax or a mixture thereof.

14. A monolayer structure comprising a vinylidene chloride polymer composition comprising (1) a vinylidene chloride polymer wherein the major component is a vinylidene chloride monomer and the remainder is one or more monoethylenically unsaturated monomer copolymerizable with the vinylidene chloride monomer, (2) a glycerol ester and (3) a silicone polymer, the glycerol ester and silicone polymer being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer, and optionally, an epoxidized processing aid.

15. A multilayer structure comprising (1) one or more layers of an organic polymer or a blend of two or more different organic polymers, the organic polymer of one layer being the same as or different from the organic polymer of another layer and (2) one or more layers of a vinylidene chloride polymer composition comprising (1) a vinylidene chloride polymer wherein the major component is a vinylidene chloride monomer and the remainder is one or more monoethylenically unsaturated monomer copolymerizable with the vinylidene chloride monomer, (2) a glycerol ester and (3) a silicone polymer, the glycerol ester and silicone polymer being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer and optionally, an epoxidized processing aid.

16. The multilayer structure of Claim 15 comprising (1) a first outer layer of the organic polymer or blend of two or more different organic polymers, (2) a core layer of the vinylidene chloride polymer composition and (3) a second outer layer of an organic polymer which is the same as or different from the organic polymer of the first outer layer.





17. The multilayer structure of Claim 15 comprising (1) a first outer layer of the vinylidene chloride polymer composition, (2) a core layer of the organic polymer or blend of two or more different organic polymers and (3) a second outer layer of an organic polymer which is the same as or different from the organic polymer of the core layer.
- 5 18. The multilayer structure of Claim 15 wherein an adhesive layer is interposed between contiguous layers of the multilayer structure.
19. The multilayer structure of Claim 15 wherein the organic polymer is a polyolefin, a polyamide or a polystyrene.
- 10 20. A five-layer or seven-layer structure having (A) one or more layers of a vinylidene chloride polymer composition comprising (1) a vinylidene chloride polymer wherein the major component is a vinylidene chloride monomer and the remainder is one or more monoethylenically unsaturated monomer copolymerizable with the vinylidene chloride monomer, (2) a glycerol ester and (3) a silicone polymer and, optionally, an epoxidized processing aid, the glycerol ester, silicone polymer and epoxidized processing aid being
15 present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer and (B) the remaining layers comprising an organic polymer or a blend of two or more different organic polymers, the organic polymer of one layer being the same as or different from the organic polymer of another layer.
- 20 21. The five-layer or seven-layer structure of Claim 20 wherein an adhesive layer is interposed between contiguous layers of the structure.
22. A monolayer or multilayer structure comprising a vinylidene chloride polymer composition comprising (1) a vinylidene chloride polymer wherein the major component is a vinylidene chloride monomer and the remainder is one or more
25 monoethylenically unsaturated monomer copolymerizable with the vinylidene chloride monomer, (2) a glycerol ester and (3) a polyolefin, the glycerol ester and polyolefin being present in an amount sufficient to improve the extrudability of the vinylidene chloride polymer.
23. A flexible or rigid container comprising the monolayer structure of Claim 14, the multilayer structure of Claim 15 or the monolayer or multilayer structure of Claim 22.

