Still another approach of making vegetable oil-based PSAs is disclosed in US patent Nos. 9,315,704 and 9,556,368. In this approach, epoxidized vegetable oils (EVO) and dicarboxylic acids/polycarboxylic acids are first polymerized via the reaction of the epoxy group of EVO and -COOH of the dicarboxylic acids/polycarboxylic acids to give prepolymers. The prepolymers are then further thermally cured to give PSAs via the same reaction between the epoxy and –COOH groups, which requires a typical cure time of from minutes to hours depending on curing temperature. The long curing time could be a bottleneck in the manufacture of the PSAs.

SUMMARY

In an aspect of the present disclosure, there is provided a pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured polymer made from:

(a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof;

(b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof; and

(c) (i) itaconic acid, fumaric acid, maleic acid, or an anhydride thereof, or a mixture thereof or (ii) acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~.

In another aspect of the present disclosure, there is provided a pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured semi-interpenetrating polymer network made from a blend of:

(a) at least one compound containing at least two acrylate or methacrylate groups;

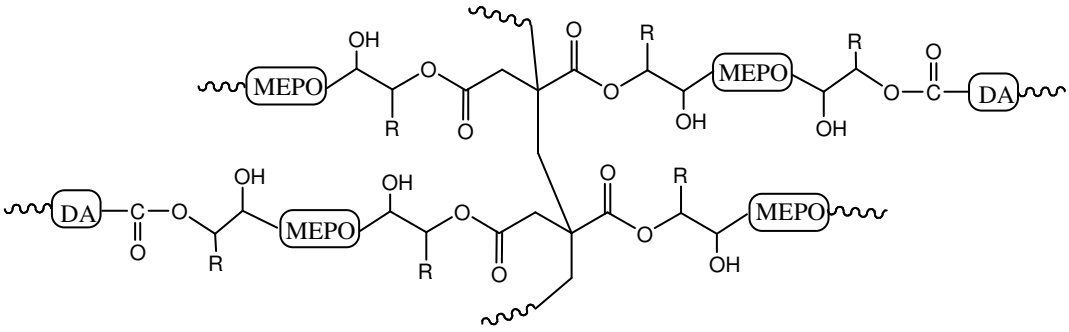
(b) a photoinitiator; and

(c) a polyester prepared from polymerization of at least one monocarboxylic acid modified-epoxidized plant oil with at least one dicarboxylic acid or polycarboxylic acid.

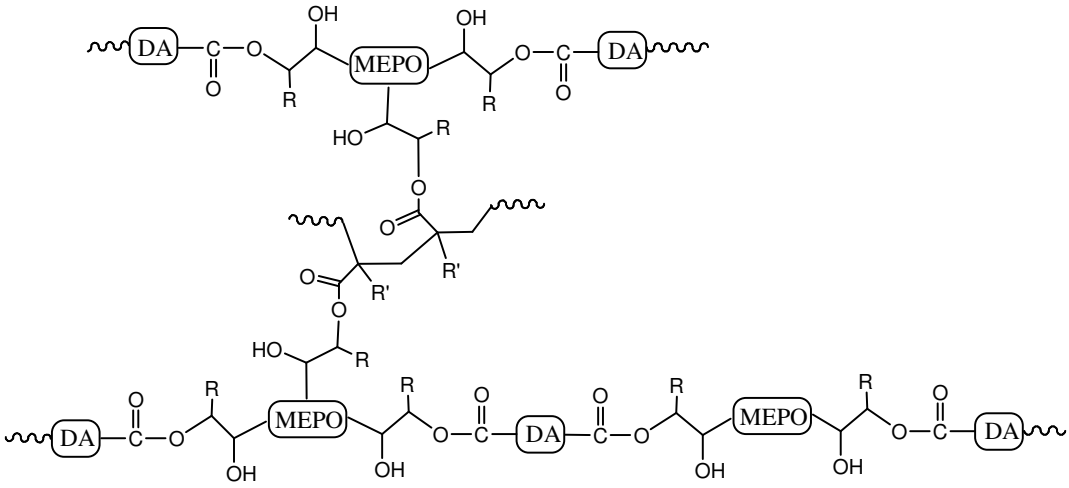
In a further aspect of the present disclosure, there is provided a pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured polymer having a structure of:



or



wherein MEPO denotes structure derived from an epoxidized plant oil or modified epoxidized plant oil; DA denotes structure derived from a dicarboxylic acid or polycarboxylic acid; each R' is independently H or methyl group; each R is independently an alkyl derived from a part of fatty acid chains from the epoxidized plant oil or the modified epoxidized plant oil; and each ~~~ represents independently a segment of a polyester chain.

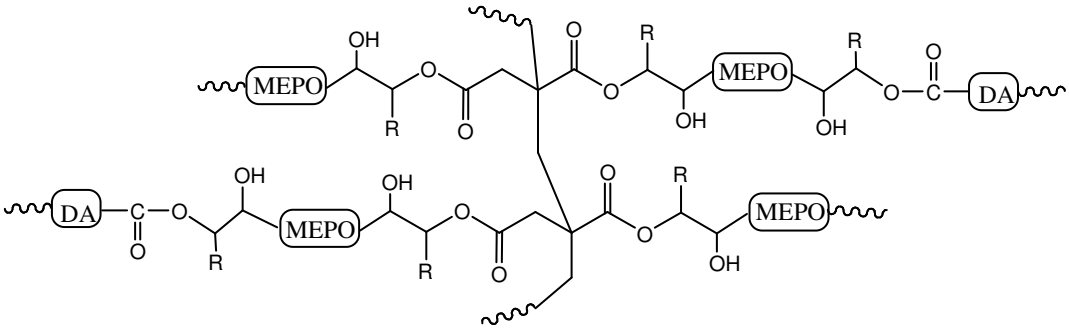
In another aspect of the present disclosure, there is provided a pressure sensitive adhesive composition comprising an ultraviolet radiation-cured polymer made from:

(a) monocarboxylic acid-modified epoxidized soybean oil or epoxidized soybean oil~~at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof~~;

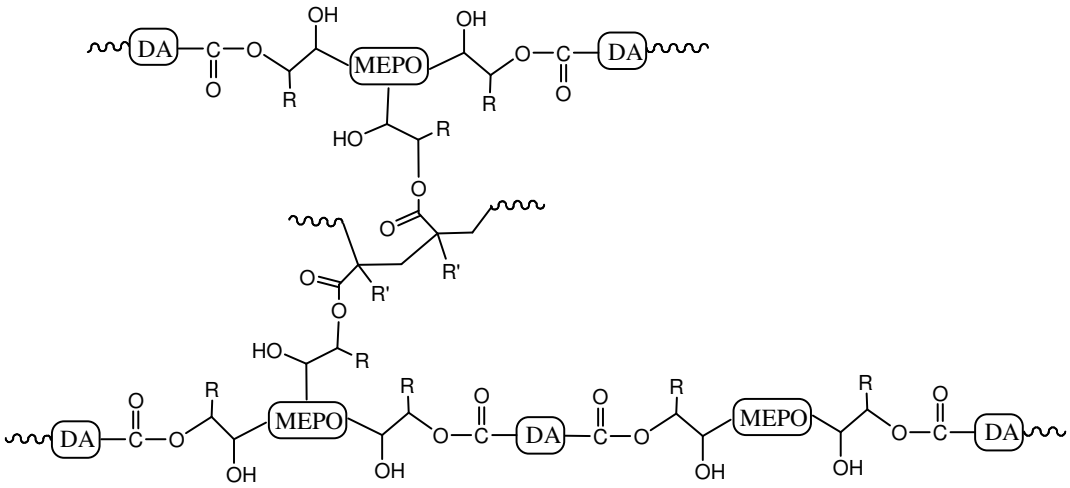
(b) a mixture of dimer acid, trimer acid, and polymeric fatty acid; or adipic acid~~at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof~~; and

(c) itaconic acid or acrylic acid~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~.

In a further aspect of the present disclosure, there is provided a pressure sensitive adhesive composition comprising a polymer having a structure of:



or



wherein MEPO denotes structure derived from an epoxidized plant oil or modified epoxidized plant oil; DA denotes structure derived from a dicarboxylic acid or polycarboxylic acid; each R' is independently H or methyl group; each R is independently an alkyl derived from a part of fatty acid chains from the epoxidized plant oil or the modified epoxidized plant oil; and each ~~~ represents independently a segment of a polyester chain.

In another aspect of the present disclosure, there is provided an ultraviolet radation-curable composition comprising:

(a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof;

(b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof;

(c) itaconic acid~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~; and

(d) at least one photoinitiator.

In a further aspect of the present disclosure, there is provided a method comprising:

polymerizing (a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof, (b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof, and (c) (i) itaconic acid, fumaric acid, maleic acid, or an anhydride thereof, or a mixture thereof or (ii) acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~;

adding at least one photoinitiator; and

subjecting the resulting resin to ultraviolet radiation to form a crosslinked polymer.

In another aspect of the present disclosure, there is provided a method for making a crosslinked polyester comprising:

step-growth polymerizing (a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof, (b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof, and (c) (i) itaconic acid, fumaric acid, maleic acid, or an anhydride thereof, or a mixture thereof or (ii) acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group to form a polyester that includes pendant C=C bonds~~; adding at least one photoinitiator; and subjecting the resulting resin to ultraviolet radiation to form a crosslinked polyester.

~~In a further aspect of the present disclosure, there is provided a pressure sensitive adhesive composition comprising the crosslinked polymer made by any one of the methods disclosed herein.~~

~~In another aspect of the present disclosure, there is provided a pressure sensitive adhesive construct comprising:~~

~~(A) a backing substrate; and~~

~~(B) a pressure sensitive adhesive composition disclosed herein, disposed on the backing substrate.~~

Disclosed herein is a pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured polymer made from:

(a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof;

(b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof; and

(c) at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group.

Also disclosed herein is a pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured semi-interpenetrating polymer network made from a blend of:

(a) at least one compound containing at least two acrylate or methacrylate groups;

(b) a photoinitiator; and

(c) a polyester prepared from polymerization of at least one monocarboxylic acid modified-epoxidized plant oil with at least one dicarboxylic acid or polycarboxylic acid.

Further disclosed herein is a pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

What is claimed is:

1. A pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured polymer made from:

(a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof;

(b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof; and

(c) ~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~(i) itaconic acid, fumaric acid, maleic acid, or an anhydride thereof, or a mixture thereof or (ii) acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof.

2. The construct of claim 1, wherein component (a) is monocarboxylic acid-modified epoxidized soybean oil.

3. The construction of claim 2, wherein the monocarboxylic acid modifier is formic acid, acetic acid, propionic acid, butyric acid, valeric acid, caproic acid, enanthic acid, caprylic acid, pelargonic acid, capric acid, undecylic acid, lauric acid, tridecylic acid, myristic acid, pentadecylic acid, palmitic acid, margaric acid, stearic acid, nonadecylic acid, arachildic acid, heneicosylic acid, behenic acid, tricosylic acid, and lignoceric acid, naphthalene acid, oleic acid, linoleic acid, myristoleic acid, palmitoleic acid, sapienic acid, elaidic acid, vaccenic acid, linoelaidic acid, linolenic acid, arachidonic acid, eicosapentaenoic acid, erucic acid, docosahexanenoic acid, abietic acid or tall oil rosin that contains abietic acid, benzoic acid, phenylacetic acid, 1-naphthaleneacetic acid, 2-naphthaleneacetic acid, 1-naphthoic acid, 2-naphthoic acid, 2-furoic acid, 3-methylpyridine-2-carboxylic acid, 1-methylpyrrole-2-carboxylic acid, pyrimidine-2-carboxylic acid, or an anhydride thereof, or a mixture thereof.

4. The construct of claim 1, wherein component (a) is epoxidized soybean oil.

5. The construct of any one of claims 1 to 4, wherein component (b) is malonic acid, succinic acid, glutaric acid, adipic acid, pimelic acid, suberic acid, azelaic acid, sebacic acid, and brassylic acid, phthalic acid, isophthalic acid, terephthalic acid, dimer acid, trimer acid, or an anhydride thereof, or a mixture thereof.

6. The construct of any one of claims 1 to 4, wherein component (b) is a mixture of dimer acid, trimer acid, and polymeric fatty acid.

7. The construct of any one of claims 1 to 4, wherein component (b) is adipic acid.

8. The construct of any one of claims 1 to 4, wherein component (b) is a polymer or an oligomer that is capped with –COOH groups at chain ends of the polymer or the oligomer.

~~9. The construct of any one of claims 1 to 8, wherein component (c) is itaconic acid, fumaric acid, maleic acid, or an anhydride thereof, or a mixture thereof.~~

~~10~~9. The construct of any one of claims 1 to 8, wherein component (c) is itaconic acid.

~~11. The construct any one of claims 1 to 8, wherein component (c) is acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof.~~

~~12~~10. The construct any one of claims 1 to 8, wherein component (c) is acrylic acid.

~~13~~11. The construct of any one of claims 1 to ~~12~~10, wherein the ultraviolet radiation-cured polymer is also made from at least one thiol containing-compound.

~~14~~12. The construct of claim ~~13~~11, wherein the thiol containing-compound is trimethylolpropane tris(3-mercaptopropionate), pentaerythritol tetrakis(3-mercaptopropionate), 1,2-bis(2-mercaptoethoxy)ethane, tetra(ethylene glycol) dithiol, poly(ethylene glycol) dithiol, 1,6-hexanedithiol, 4,4'-thiobisbenozenethiol, a thiol containing-plant oil, or a mixture thereof.

~~15~~13. The construct of claim ~~13~~11, wherein the thiol-containing compound is a mercaptanized soybean oil from reaction of soybean oil with hydrogen disulfide, or a mercapto hydroxy soybean oil from reaction of epoxidized soybean oil with hydrogen disulfide.

~~16~~14. A pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured semi-interpenetrating polymer network made from a blend of:

(a) at least one compound containing at least two acrylate or methacrylate groups;

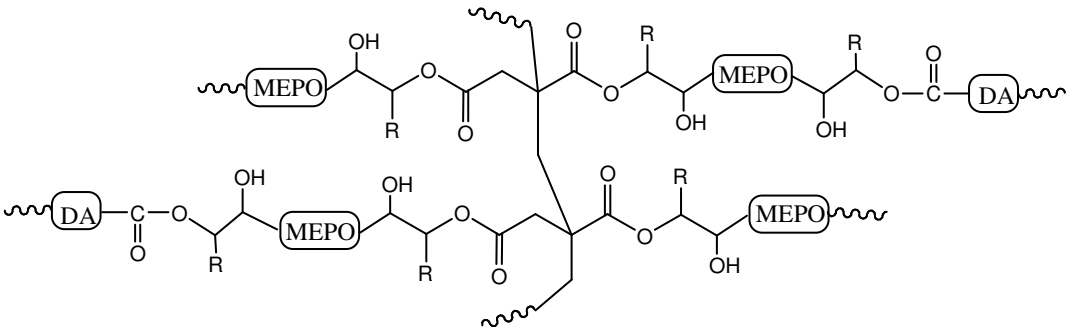
(b) a photoinitiator; and

(c) a polyester prepared from polymerization of at least one monocarboxylic acid modified-epoxidized plant oil with at least one dicarboxylic acid or polycarboxylic acid.

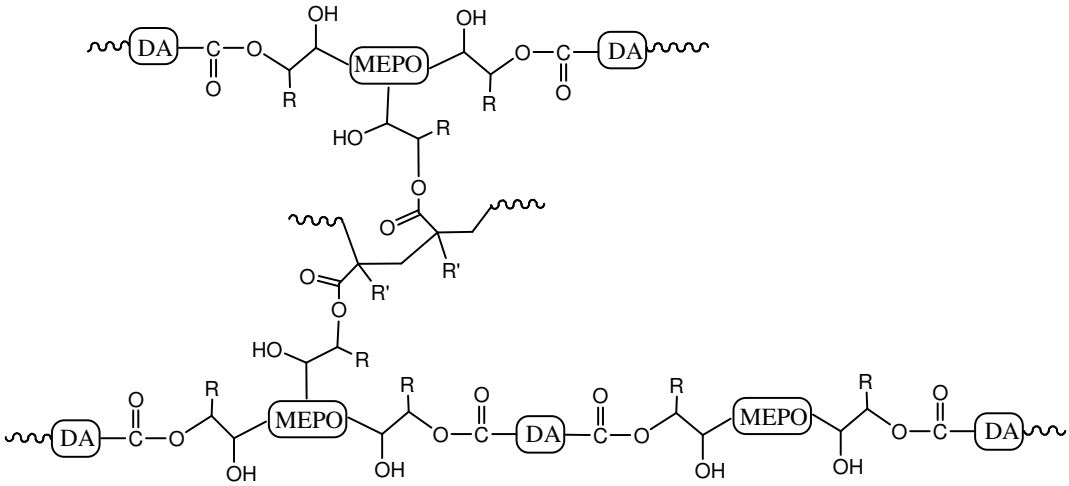
~~17~~15. A pressure sensitive adhesive construct comprising:

(A) a backing substrate; and

(B) a pressure sensitive adhesive composition disposed on the backing substrate, wherein the pressure sensitive adhesive composition includes an ultraviolet radiation-cured polymer having a structure of:



or



wherein MEPO denotes structure derived from an epoxidized plant oil or modified epoxidized plant oil; DA denotes structure derived from a dicarboxylic acid or polycarboxylic acid; each R' is independently H or methyl group; each R is independently an alkyl derived from a part of fatty acid chains from the epoxidized plant oil or the modified epoxidized plant oil; and each ~~ represents independently a segment of a polyester chain.

~~18~~16. A pressure sensitive adhesive composition comprising an ultraviolet radiation-cured polymer made from:

(a) ~~at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof~~ monocarboxylic acid-modified epoxidized soybean oil or epoxidized soybean oil;

(b) ~~at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof~~ a mixture of dimer acid, trimer acid, and polymeric fatty acid; or adipic acid; and

(c) ~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~ itaconic acid or acrylic acid.

~~19. The composition of claim 18, wherein:~~

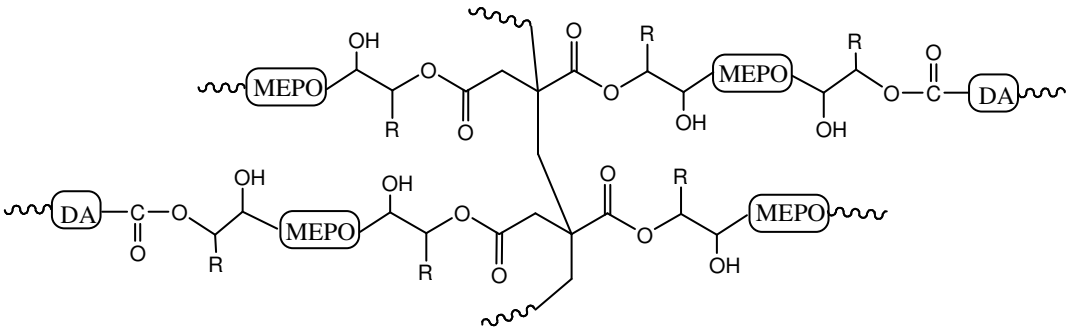
~~component (a) is monocarboxylic acid-modified epoxidized soybean oil or epoxidized soybean oil;~~

~~component (b) is a mixture of dimer acid, trimer acid, and polymeric fatty acid; or adipic acid; and~~

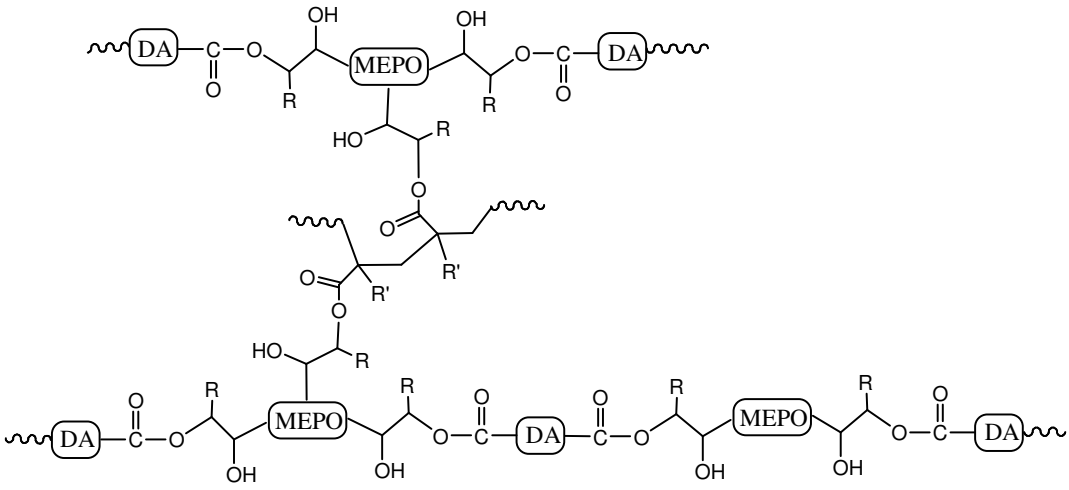
~~component (c) is itaconic acid or acrylic acid.~~

~~20~~17. The composition of claim ~~18~~16, wherein the ultraviolet radiation-cured polymer is also made from at least one thiol containing-compound.

~~21~~18. A pressure sensitive adhesive composition comprising a polymer having a structure of:



or



wherein MEPO denotes structure derived from an epoxidized plant oil or modified epoxidized plant oil; DA denotes structure derived from a dicarboxylic acid or polycarboxylic acid; each R' is independently H or methyl group; each R is independently an alkyl derived from a part of fatty acid chains from the epoxidized plant oil or the modified epoxidized plant oil; and each ~~~ represents independently a segment of a polyester chain.

~~22~~19. The composition of any one of claims ~~18~~ 16 to ~~21~~18, further comprising a tackifier.

~~23~~20. The composition of claim ~~23~~19, wherein the tackifier is the reaction product of an epoxidized plant oil with tall oil rosin.

~~24~~21. An ultraviolet radation-curable composition comprising:

(a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof;

(b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof;

(c) ~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~itaconic acid; and

(d) at least one photoinitiator.

~~25~~22. A method comprising:

polymerizing (a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof, (b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof, and (c) ~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group~~(i) itaconic acid, fumaric acid, maleic acid, or an anhydride thereof, or a mixture thereof or (ii) acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof;

adding at least one photoinitiator; and

subjecting the resulting resin to ultraviolet radiation to form a crosslinked polymer.

~~26~~23. The method of claim ~~25~~22, wherein the polymerizing is performed in the presence of a magnesium-containing catalyst.

~~27~~24. The method of claim ~~26~~23, wherein the magnesium-containing catalyst is magnesium acetate hydrate, magnesium acetate anhydrous, magnesium stearate, magnesium hydroxide, magnesium chloride hydrate, magnesium chloride anhydrous or a mixture thereof.

~~28~~25. The method of claim ~~25~~22, further comprising modifying the at least one epoxidized plant oil, at least one epoxidized animal fat, or mixture thereof, with at least one monocarboxylic acid.

~~29~~26. The method of claim ~~28~~25, wherein the modifying is performed prior to the polymerizing.

~~30~~27. The method of claim ~~28 25~~ or ~~29~~26, wherein the modifying occurs in the presence of a magnesium-containing catalyst.

~~31~~28. The method of claim ~~30~~27, wherein the magnesium-containing catalyst is magnesium acetate hydrate, magnesium acetate anhydride, magnesium hydroxide or a mixture thereof.

~~32~~29. The method of any one of claims ~~28 25~~ to ~~31~~28, comprising forming a reaction mixture of (a) the monocarboxylic acid-modified epoxidized plant oil, monocarboxylic acid-modified epoxidized animal fat, or monocarboxylic acid-modified mixture thereof, component (b) and component (c); heating the reaction in the presence of a catalyst to form a polyester that includes pendant C=C bonds.

~~33~~30. The method of claim ~~25~~22, comprising initially reacting component (a) with component (c), and optionally at least one monocarboxylic acid, to form a modified component (a) that includes at least one pendant C=C bond; and subsequently reacting the modified component (a) with component (b) to form a polyester that includes pendant C=C bonds.

~~34~~31. The method of claim ~~33~~30, wherein component (c) is acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof.

~~35~~32. A method for making a crosslinked polyester comprising:

step-growth polymerizing (a) at least one epoxidized plant oil, at least one epoxidized animal fat, or a mixture thereof, (b) at least one dicarboxylic acid, at least one polycarboxylic acid, or a mixture thereof, and (c) ~~at least one compound that contains both one carbon-carbon double bond (C=C) and at least one carboxylic acid group to form a polyester that includes pendant C=C bonds~~(i) itaconic acid, fumaric acid, maleic acid, or an anhydride thereof, or a mixture thereof or (ii) acrylic acid, methacrylic acid, or an anhydride thereof, or a mixture thereof; adding at least one photoinitiator; and subjecting the resulting resin to ultraviolet radiation to form a crosslinked polyester.

~~36~~33. A pressure sensitive adhesive composition comprising the crosslinked polymer made by any one of the methods of claims ~~25~~22 to ~~35~~32.

~~37. A pressure sensitive adhesive composition comprising the crosslinked polymer made by the method of claim 35.~~

~~38. A pressure sensitive adhesive construct comprising:~~

~~(A) a backing substrate; and~~

~~(B) a pressure sensitive adhesive composition of claim 36 or 37 disposed on the backing substrate.~~

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