C6-C12 carboxylic acids were referred to as suitable for use as plasticizers. The synthesis of isosorbide di-n-octanoate (IsDO) and isosorbide di-2-ethylhexanoate (IsDEH) was exemplified.

WO2006/103338 describes a method of producing *inter alia* isosorbide esters by using a combination of two catalysts, one of which is hypophosphorous acid. This appears to give esters having better colour numbers and higher purities than described in WO2001/083488 for example. Again, only 2-ethylhexanoic acid and n-octanoic acid were explicitly referred to as carboxylic acids which can be reacted using this method.

WO 2008/095571 describes synthesis and use of mixtures of isosorbide esters obtainable by esterifying isomeric nonanoic acids (branched and linear) with isosorbide. However, plastisols based on this plasticizer have a significantly higher viscosity than that of the current standard plasticizer diisononyl phthalate (DINP), portending worse processability. Similarly, the glass transition temperatures are very significantly inferior to that of DINP.

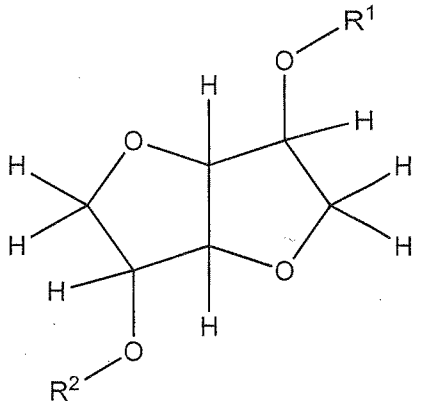
The melting point of the pure isosorbide diester of n-octanoic acid is only just below room temperature, so using the ester at lower temperatures would be uncommercial in many processing methods of PVC plastisol technology.

The corresponding pure isosorbide di-n-decanoate even has a melting point above 35°C, and is largely incompatible with PVC.

The problem addressed by the present invention was that of finding a dianhydrohexitol-based diester or diester mixture having improved performance characteristics.

The problem is solved by an ester mixture as defined in Claim 1.

~~In a first aspect, there is provided a~~An ester mixture comprising a compound conforming to formula I:



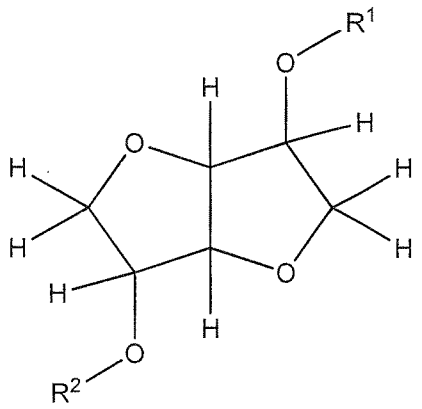
I

wherein R^1 and R^2 are each independently selected from: C8-alkyl linear, C8-alkyl branched, C8-alkene wherein said C8-alkene may be partially or completely epoxidized, C10-alkyl linear, C10-alkyl branched, C10-alkene wherein said C10-alkene may be partially or completely epoxidized, and

wherein the carbon atom which binds the particular R^1 or R^2 moiety directly to the oxygen in formula I is linked via a double bond to a further oxygen atom, and

wherein the ester mixture has a mean chain length of from 8.3 to 9.2.

In a first aspect, there is provided an ester mixture comprising a compound conforming to formula I:



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wherein R^1 and R^2 are each independently selected from: C8-alkyl linear and C10-alkyl linear, and wherein the carbon atom which binds the particular R^1 or R^2 moiety directly to the oxygen in formula I is linked via a double bond to a further oxygen atom, and wherein the ester mixture has a mean chain length of from 8.3 to 9.2.

In a second aspect, there is provided a composition comprising:

- an ester mixture as defined above,
- a high boiler and/or a low boiler.

In a third aspect, there is provided a polymer composition comprising:

- an ester mixture as defined above,
- a polymer.

In a fourth aspect, there is provided the use of an ester mixture as defined above as a plasticizer.

In a fifth aspect, there is provided a method to produce an ester mixture comprising the steps of

a) providing a dianhydrohexitol,

b) admixing n-octanoic acid and n-decanoic acid,

c) esterifying the acids of b) with the alcohol of a) in the presence of at least one catalyst,

d) terminating the esterifying reaction of c) as soon as the proportion of monoester has fallen below 2.0 area% obtained by gas-chromatographic methods under use of an FID detector, wherein the ester mixture has a mean chain length of from 8.3 to 9.2.

C8 or as the case may be C10 refers to the number of carbon atoms in the carbon chain.

In connection with this invention, "chain length" is to be understood as meaning the mean chain length of the R^1 and R^2 moieties in the ester mixture.

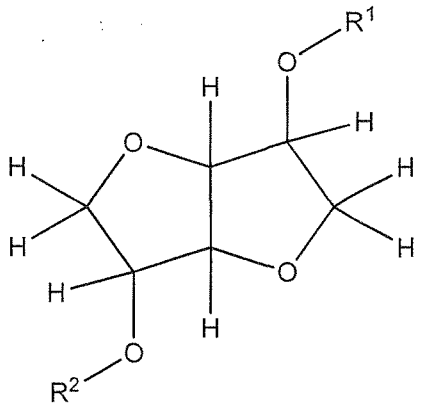
The procedure which will now be described relates to the determination of the mean chain length of the side chains of the isosorbide esters, but can also be applied *mutatis mutandis* to other dianhydrohexitol diester mixtures.

The mean chain lengths of the fatty acids in dianhydrohexitol di-fatty acid esters are determined via ^1H NMR spectroscopy. The spectra are recorded by, for example, dissolving 50 mg of substance in 0.6 ml of $CDCl_3$ (comprising 1% by mass of TMS) and charging the solution to an NMR vial 5 mm in diameter. Both the substance to be investigated and the $CDCl_3$ used are first dried over molecular sieve in order to forestall errors in the values measured due to any water present.

In principle, any commercially available NMR equipment can be used for the NMR-

Claims:

1. An ester mixture comprising a compound conforming to formula I:



I

wherein R^1 and R^2 are each independently selected from: C8-alkyl linear~~, C8-alkyl branched, C8-alkene wherein said C8-alkene may be partially or completely epoxidized,~~and C10-alkyl linear, ~~C10-alkyl branched, C10-alkene wherein said C10-alkene may be partially or completely epoxidized,~~ and

wherein the carbon atom which binds the particular R^1 or R^2 moiety directly to the oxygen in formula I is linked via a double bond to a further oxygen atom, and

wherein the ester mixture has a mean chain length of from 8.3 to 9.2.

2. An ester mixture according to Claim 1,

wherein the ester mixture has a mean chain length of from 8.3 to 9.1.

3. An ester mixture according to either of Claims 1 and 2,

wherein the ester mixture has a mean chain length of from 8.5 to 9.1.

4. An ester mixture according to any of Claims 1 to 3,

wherein the sum of C8 and C10 has a proportion of above 50 mol% in the entire ester mixture based on all acid chains.

~~5. An ester mixture according to any of Claims 1 to 4,~~

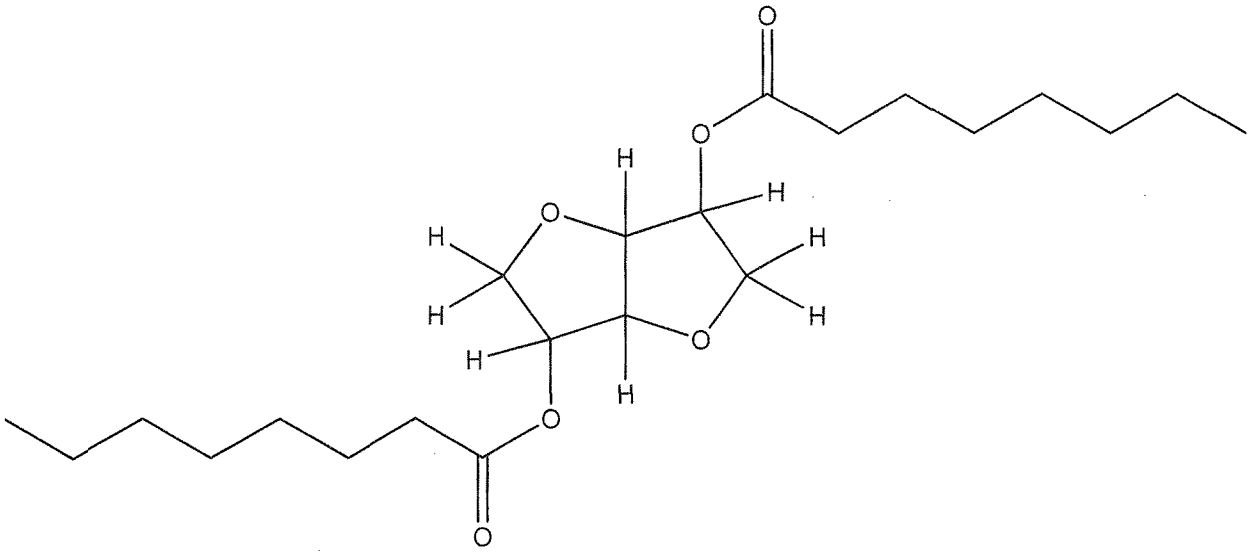
~~wherein R^1 is selected from: C8-alkyl linear, C10-alkyl linear.~~

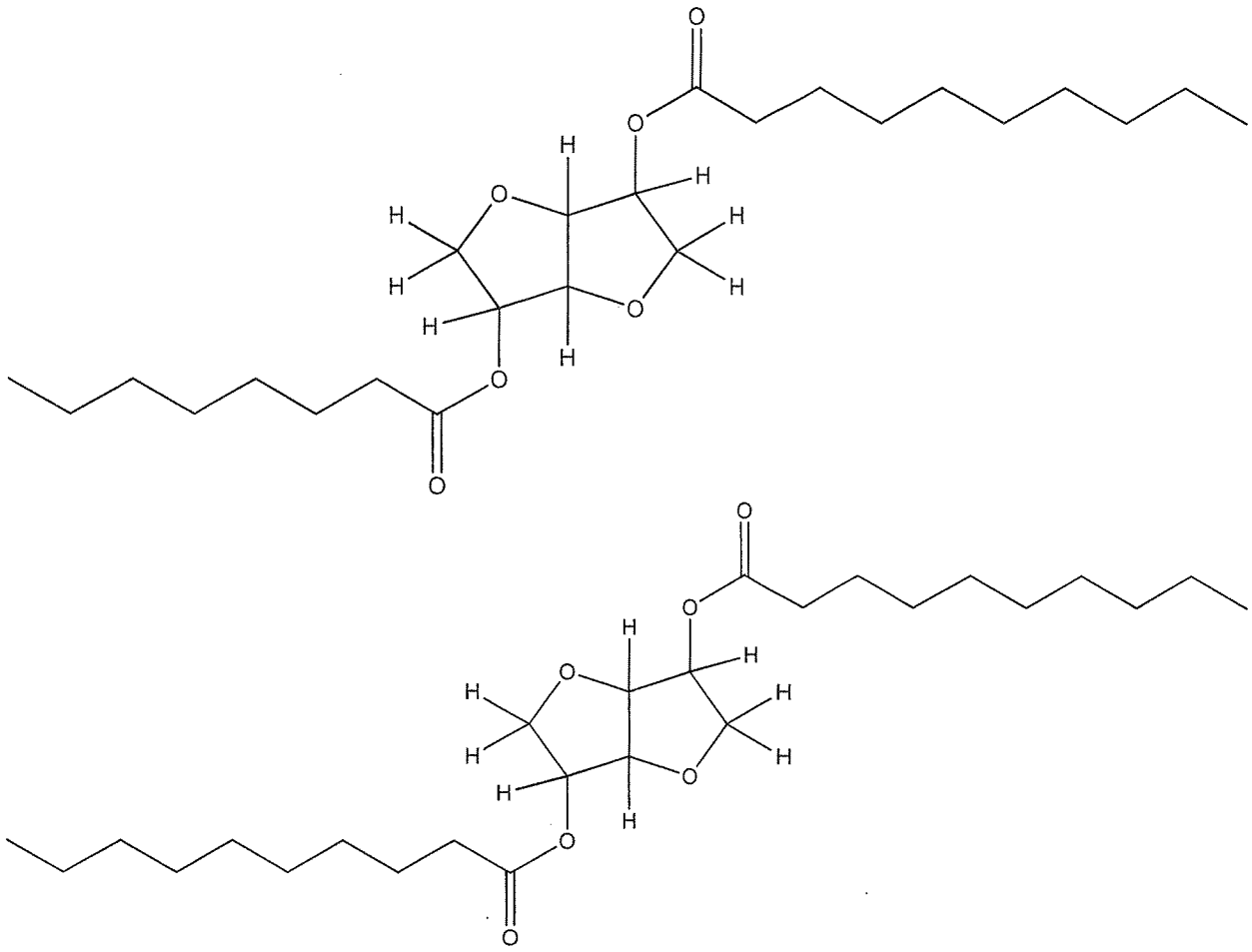
~~6. An ester mixture according to any of Claims 1 to 5,~~

~~wherein R^2 is selected from: C8-alkyl linear, C10-alkyl linear.~~

57. An ester mixture according to any of Claims 1 to 46,

wherein said ester mixture comprises a mixture of the following three compounds:





68. A composition comprising:

- an ester mixture according to any of Claims 1 to 57,
- a high boiler and/or a low boiler.

79. A composition according to Claim 68,

wherein the proportion of high boilers is less than 15 area% obtained by gas-chromatographic methods under use of an FID detector based on the ester signals of the composition.

810. A composition according to either of Claims 68 and 79,

wherein the proportion of low boilers is less than 4.5 area% obtained by gas-chromatographic methods under use of an FID detector based on the ester signals of the composition.

911. A polymer composition comprising:

- an ester mixture according to any of Claims 1 to 5~~7~~,
- a polymer.

10~~2~~. The use of an ester mixture according to any of Claims 1 to 5~~7~~ as a plasticizer.

11~~3~~. A method to produce an ester mixture comprising the steps of

a) providing a dianhydrohexitol,

b) admixing n-octanoic acid and n-decanoic acid,

c) esterifying the acids of b) with the alcohol of a) in the presence of at least one catalyst,

d) terminating the esterifying reaction of c) as soon as the proportion of monoester has fallen below 2.0 area% obtained by gas-chromatographic methods under use of an FID detector,

wherein the ester mixture has a mean chain length of from 8.3 to 9.2.

12~~4~~. A method according to Claim 11~~3~~,

wherein the catalyst used in step c) is hypophosphorous acid.

13~~5~~. A method according to either of Claims 11~~3~~ and 12~~4~~,

wherein n-octanoic acid and n-decanoic acid are admixed in step b) in a molar ratio in the range from 85:15 and 45:55.

14~~6~~. A method according to either of Claims 11~~3~~ and 12~~4~~,

wherein n-octanoic acid and n-decanoic acid are admixed in step b) in a molar ratio in the range from 80:20 and 45:55.