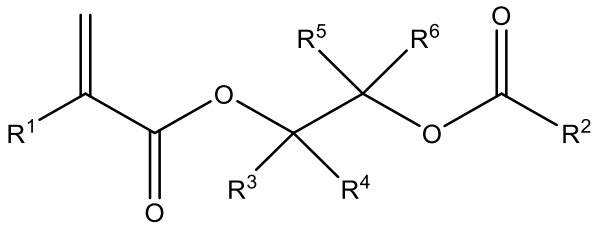
Claims

1. Process for preparation of a diester of general Formula (I)



(I)

with

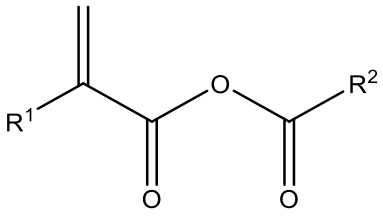
R^1 being a hydrogen atom or a methyl group,

R^2 to R^6 being independently selected from hydrogen atoms or optionally substituted aliphatic or aromatic substituents having up to 17 carbon atoms,

R^3 and R^5 or R^4 and R^6 /or R^3 and R^4 optionally building a ring structure,

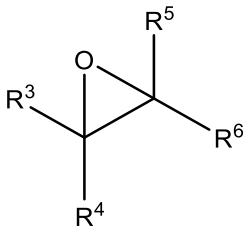
wherein the process comprises at least the following process step (a):

(a) a reaction between a (meth)acrylic anhydride of general Formula (II)



(II)

and an epoxide of general Formula (III),



(III)

to deliver a product mixture comprising the diester of general Formula (I);

wherein the reaction is carried out in the presence of a catalyst in combination with a co-catalyst, the catalyst being a first catalyst, a second catalyst or a combination of both, wherein

- the first catalyst is a fluoride, chloride, bromide, iodide or perchlorate of magnesium or a trifluoromethanesulfonate of a rare earth element; and
- the second catalyst is a chromium (III) salt,

and the co-catalyst is selected from the group consisting of a tertiary amine, a quaternary ammonium salt, a tertiary phosphine, and a quaternary phosphonium salt.

2. The process according to Claim 1, wherein R^1 is a hydrogen atom and R^2 is a vinyl group and the (meth)acrylic anhydride of formula (II) is acrylic acid anhydride, or, alternatively, wherein R^1 is a methyl group and R^2 is a 1-methylvinyl group and the (meth)acrylic anhydride of formula (II) is methacrylic acid anhydride.

3. The process according to Claim 1, wherein the optionally substituted aliphatic or aromatic substituents having up to 17 carbon atoms are selected from the group consisting of optionally substituted alkyl, cycloalkyl, alkenyl, or alkadienyl substituents having up to 17 carbon atoms, optionally substituted with one substituent R^7 being selected from a halogen atom, -CN, -SCN, -OCN, and –NCO.

4. The process according to any one of the preceding claims, wherein the epoxide of general Formula (III) is selected from the group consisting of ethylene oxide, propylene oxide, 1-hexene oxide, cyclohexene oxide, cyclopentene oxide, 1-butene oxide, 2-butene oxide, isobutene oxide, styrene oxide and glycidyl methacrylate.

5. The process according to any one of the preceding claims, wherein the process step (a) is carried out in the presence of the first catalyst, the second catalyst and the co-catalyst.

6. The process according to any one of the preceding claims, wherein the co-catalyst is a quaternary ammonium salt selected from the group consisting of tetrabutylammonium chloride, tetrabutylammonium bromide, tetraethylammonium chloride, tetrabutylammonium acetate, tetramethylammonium chloride, tetrapentylammonium bromide, cetyl-trimethylammonium bromide, 1-butyl-3-methyl-imidazolyl chloride, cetylpyridinium chloride and triethylbenzylammonium chloride.

7. The process according to any one of Claims 1 to 6, wherein the second catalyst is a chromium (III) carboxylate.

8. The process according to claim 7, wherein the chromium (III) carboxylate is selected from the group consisting of chromium (III) 2-ethylhexanoate, chromium (III) heptanoate, chromium (III) acetate or chromium (III) methacrylate.

9. The process according to any one of the preceding claims, wherein the total amount of the first catalyst in the process step (a) is between 0.001 mol.-% and 10 mol.-%, based on the amount of the epoxide of general Formula (III).

10. The process according to any one of the preceding claims, wherein the total amount of the second catalyst in the process step (a) is between 0.001 mol.-% and 10 mol.-%, based on the amount of the epoxide of general Formula (III).

11. The process according to any one of the preceding claims, wherein the total amount of the co-catalyst in the process step (a) is typically chosen to be between 0.001 mol.-% and 10 mol.-%, based on the amount of the epoxide of general Formula (III).

12. The process according to any one of the preceding claims, wherein the molar ratio anhydride of the general Formula (II) : epoxide of the general Formula (III) in the process step (a) is between 5 : 1 and 1 : 0.1.

13. The process according to any one of the preceding claims, wherein the temperature during the process step (a) is kept between 20 °C and 140 °C.

14. The process any one of the preceding claims, wherein the process is carried out in the presence of at least 10 mol% excess of the anhydride based on the amount of epoxide of general Formula (III).

15. The process according to claim 14, further comprising the following process steps (b) and (c) being carried out after the process step (a):

(b) addition of an auxiliary alcohol to the product mixture obtained in the process step (a), whereby a product mixture comprising the diester of the general Formula (I) is formed and an ester of the auxiliary alcohol is formed; and
(c) removal of the ester of the auxiliary alcohol from the product mixture obtained in the process step (b);

wherein the auxiliary alcohol is a primary or secondary alcohol having a boiling point of not more than 150°C, measured at a pressure of 10^5 Pa.