**Claims**

1. An alkoxycarbonylation ~~P~~process for preparing an ester by carbonylation of a C2 to C16 ~~hydrocarbon~~alkene or isoalkene, ~~with~~ wherein the alkoxycarbonylation process comprises~~ing~~ the following steps:

   a) ~~reacting (~~carbonylating~~)~~ a C2 to C16 alkene or isoalkene~~hydrocarbon~~ having at least one olefinic double bond with carbon monoxide and with an alcohol wherein the alcohol that is a mono- or polyol (two or more OH groups) ~~having~~ have from 1 to 50 carbon atoms or is a mixture of two or more mono- and/or polyols and which, when it is a monool, is used in a molar ratio to the C2 to C16 hydrocarbon (alcohol:C2 to C16 hydrocarbon) of from 2 to 20 or which, when it is a polyol, is used in a molar ratio to the alkene or isoalkene~~hydrocarbon~~ used (alkene or isoalkene~~hydrocarbon~~:polyol) of from 2 to 20, in the presence of a homogeneous catalyst system comprising at least one metal of groups 8 to 10 of the periodic table of the elements or a compound thereof, a phosphorus-containing ligand and an acid, in a reaction zone of step a) to obtain a liquid product mixture that comprises at least the ester formed by the reaction, the homogeneous catalyst system, low boilers, high boilers and unreacted alcohols of step a);

   b) carrying out a membrane separation with a membrane material to separate the homogeneous catalyst system from the liquid product mixture, whereby the homogeneous catalyst system and ~~additionally unreacted hydrocarbon and/or unreacted alcohol, preferably~~ unreacted alcohol of step a), are enriched in ~~the~~ a retentate and the ester formed in step a) is enriched in ~~the~~ a permeate,

   wherein the membrane material used is an OSN (organic solvent nanofiltration) comprising a separation-active layer comprising a PEEK (polyether ether ketone) polymer, and a porous backing and the membrane material ~~that is acid-stable, i.e.~~is stable in the presence of the acid of the catalyst system and not destroyed for at least 300 hours wherein the acid in the catalyst system is a Brønsted acid having a pKa <5 or a Lewis acid, and the membrane material has a membrane retention R for the ligand of the homogeneous catalyst system is at least 75%, and worsens by not more than 30 percentage points; or a relative permeability $P_{rel}$ value between 30% and 300%, and the retentate is recycled into the reaction zone and wherein on recycling the retentate, a purge stream is removed from the retentate~~, and has at least one surface-active layer, and the retentate is recycled into the reaction zone~~;

c) working up the permeate by means of one or more separation steps selected from thermal separation, extraction, crystallization or membrane separation, ~~preferably~~ by means of one or more distillation steps, for removing the ester formed in step a) and for removing the unreacted C2 to C16 ~~hydrocarbon~~ alkene or isoalkene having at least one olefinic double bond and/or the unreacted alcohol and recycling of the unreacted C2 to C16 ~~hydrocarbon~~ alkene or isoalkene having at least one olefinic double bond and/or the unreacted alcohol of step a) into the reaction zone of step a);

and wherein the molar ratio of the Brønsted acid to ligand is from 1:1 to 15:1, and the molar ratio of Lewis acid to ligand is from 1:1 to 20:1.

2. The alkoxycarbonylation ~~P~~process according to Claim 1, wherein~~, after being used for at least 300 hours in the membrane separation process in step b) described herein,~~ the membrane material ~~according to the invention exhibits~~has the following two characteristics:

- the membrane retention R for the ligand of the homogeneous catalyst system is at least ~~75%, preferably~~ 85%, ~~more preferably 90%,~~ and worsens by not more than 30 percentage points~~, preferably not more than 20 percentage points, more preferably not more than 10 percentage points~~; or
- the relative permeability $P_{rel}$ has a value between 30% and 300%~~, preferably between 50% and 150%, more preferably between 75% and 125%~~; and
- the acid in the catalyst system is selected from the group consisting of a Brønsted acid having a pKa <3 and a Lewis acid, wherein the molar ratio of the Bronsted acid to ligand is from 1:1 to 10:1, and the molar ratio of Lewis acid to ligand is from 2:1 to 15:1.

3. The alkoxycarbonylation ~~P~~process according to Claim 1~~ or 2~~, wherein the ~~separation-active layer is composed of a PAEK (polyaryl ether ketone) polymer~~PEEK polymer has a degree of sulfonation of less than 20%.

4. The alkoxycarbonylation ~~P~~process according to Claim 3, wherein the ~~separation-active layer is composed of PEEK (polyether ether ketone)~~PEEK polymer has a degree of sulfonation of less than 10%.

5. The alkoxycarbonylation ~~P~~process according to ~~any of the preceding claims~~Claim 1, wherein the alcohol used in step a) is selected from the group consisting of ethanol, 1-propanol, 1-butanol, 1-pentanol, 1-hexanol, 2-propanol, tert-butanol, and 3-pentanol~~a mono- or polyol (two or more OH groups) having 1 to 15 carbon atoms or a mixture of two or more mono- and/or polyols~~.

6. The alkoxycarbonylation Pprocess according to Claim 5, wherein the alcohol used in step a) is selected from the group consisting of ethanol, 1-propanol, 1-butanol, 1-pentanol, 1-hexanol, 2-propanol, tert-butanol, 3-pentanol, and 2-propylheptanol~~methanol, ethanol, 1-propanol, 1-butanol, 1-pentanol, 1-hexanol, 2-propanol, tert-butanol, 3-pentanol, 2-propylheptanol, cyclohexanol, phenol and mixtures thereof~~.

7. The alkoxycarbonylation Pprocess according to ~~any of the preceding claims~~Claim 1, wherein the C2 to C16 ~~hydrocarbon~~ alkene or isoalkene having at least one olefinic double bond that is used in step a) is an n- or isoalkene having 2 to 16 carbon atoms.

8. The alkoxycarbonylation Pprocess according to ~~any of the preceding claims~~Claim 1, wherein the metal of groups 8 to 10 of the periodic table of the elements or a compound thereof in the homogeneous catalyst system in step a) is palladium or a compound thereof.

9. The alkoxycarbonylation Pprocess according to ~~any of the preceding claims~~Claim 1, wherein the phosphorus ligand in the homogeneous catalyst system has a bidentate structure.

10. The alkoxycarbonylation Pprocess according to ~~any of the preceding claims~~Claim 1, wherein the acid in the catalyst system in step a) is a Brønsted acid having a pKa ≤ 5~~, preferably having a pKa ≤ 3~~, or a Lewis acid having a~~n~~ Lewis acid unit (LAU) value of more than 25~~, preferably having an LAU value of 29~~.

11. The alkoxycarbonylation Pprocess according to ~~any of the preceding claims~~Claim 1, wherein the acid in the catalyst system in step a) is a Brønsted acid or a Lewis acid, the Brønsted acid being perchloric acid, sulfuric acid, phosphoric acid, methylphosphonic acid or a sulfonic acid, and the Lewis acid being aluminium triflate, aluminium chloride, aluminium hydride, trimethylaluminium, tris(pentafluorophenyl)borane, boron trifluoride, boron trichloride or a mixture thereof.

12. The alkoxycarbonylation Pprocess according to ~~any of the preceding claims~~Claim 1, wherein the reaction zone ~~for the reaction in~~of step a) includes at least one reactor.

13. The alkoxycarbonylation process according to Claim 2, wherein the acid in the catalyst system in step a) is a Brønsted acid having a pKa ≤ 3, or a Lewis acid having an LAU value of more than 25,
wherein the molar ratio of the Bronsted acid to ligand is from 3:1 to 5:1, and the molar ratio of Lewis acid to ligand is from 5:1 to 10:1.

14. The alkoxycarbonylation process according to Claim 1, wherein the membrane material according to the invention exhibits the following two characteristics:
    - the membrane retention R for the ligand of the homogeneous catalyst system is at least 85%, and worsens by not more than 20 percentage points; or
    - the relative permeability $P_{rel}$ has a value between 50% and 150%.

15. The alkoxycarbonylation process according to Claim 1, wherein the membrane material according to the invention exhibits the following two characteristics:
    - the membrane retention R for the ligand of the homogeneous catalyst system is at least 90%, and worsens by not more than 10 percentage points; or
    - the relative permeability $P_{rel}$ has a value between 75% and 125%.

16. The alkoxycarbonylation process according to Claim 1, wherein the acid in the catalyst system in step a) is a Brønsted acid having a pKa ≤ 3, or a Lewis acid having an LAU value of more than 25.

17. The alkoxycarbonylation process according to Claim 2, wherein the PEEK polymer has a degree of sulfonation of less than 20%.

18. The alkoxycarbonylation process according to Claim 17, wherein the PEEK polymer has a degree of sulfonation of less than 20%.

~~13. Process according to any of the preceding claims, wherein the process after the separation in step c) includes the following further steps:~~

~~d) transesterifying the ester formed in step a) with a second alcohol, wherein this second alcohol differs from the alcohol used in step a), in a second reaction zone to obtain a second product mixture comprising at least the ester with the second alcohol, the eliminated first alcohol and unreacted second alcohol, wherein the second alcohol is used in an equimolar amount or in excess;~~

~~e) separating the ester formed with the second alcohol from the rest of the second product mixture and in particular from the eliminated first alcohol by means of one or more separation steps selected from thermal separation, extraction, crystallization or membrane separation, preferably by thermal separation and/or by means of membrane separation, and recycling of the eliminated first alcohol into the first reaction zone from step a) and recycling of the unreacted second alcohol into the second reaction zone.~~

~~14. Process according to Claim 10 or 11, wherein the second alcohol used in step e) is a more high-boiling alcohol than the first alcohol.~~

~~15. Process according to any of Claims 10 to 12, wherein a proportion of the eliminated first alcohol is already withdrawn from the second reaction zone and recycled into the first reaction zone.~~