~~In a first aspect, there is provided~~The present disclosure provides a method of producing esters by carbonylation, characterized in that it is carried out

i) using at least one palladium-containing compound,

ii) at least one olefinically unsaturated compound,

iii) at least one phosphorus-containing ligand,

iv) at least one formate,

v) at least one alcohol,

vi) at least one acid,

vii) in a temperature range of 80°C to 120°C,

viii) at a reaction pressure of 0.1 to 0.6 MPa.

In one aspect, there is provided a method of producing esters by carbonylation, characterized in that it is carried out

i) using at least one palladium-containing compound,

ii) at least one olefinically unsaturated compound,

iii) at least one phosphorus-containing ligand,

iv) at least one formate,

v) at least one alcohol,

vi) at least one acid,

vii) in a temperature range of 80°C to 120°C,

viii) at a reaction pressure of 0.1 to 0.6 MPa,

characterized in that the acid is selected from the group of sulphonic acids.

In ~~a second aspect~~an embodiment, there is provided a multiphasic reaction mixture containing:

i) at least one olefinically unsaturated compound, and

ii) at least one methyl ester,

characterized by a method as defined above.

In ~~a third aspect~~another embodiment, there is provided a nonoic acid methyl ester mixture obtained by a method as defined above.

Detailed description of the invention

The invention provides a method of producing esters by carbonylation, characterized in that it is carried out

i) using at least one palladium-containing compound,

ii) at least one olefinically unsaturated compound,

iii) at least one phosphorus-containing ligand,

iv) at least one formate,

Claims

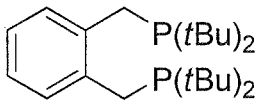
1. A method of producing esters by carbonylation, characterized in that it is carried out
   - i) using at least one palladium-containing compound,
   - ii) at least one olefinically unsaturated compound,
   - iii) at least one phosphorus-containing ligand,
   - iv) at least one formate,
   - v) at least one alcohol,
   - vi) at least one acid,
   - vii) in a temperature range of 80°C to 120°C,
   - viii) at a reaction pressure of 0.1 to 0.6 MPa,

   characterized in that the acid is selected from the group of sulphonic acids.

2. A method according to claim 1, characterized in that the phosphorus-containing ligand comprises trivalent phosphorus.

3. A method according to claim 2, characterized in that the phosphorus-containing ligand comprises a bidentate structure.

4. A method according to claim 3, characterized in that the phosphorus-containing ligand of bidentate structure conforms to formula **1**:



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5. A method according to claim 1, characterized in that the formate is selected from methyl formate, ethyl formate, benzyl formate, phenyl formate.

6. A method according to claim 5, characterized in that the at least one alcohol corresponds to the particular formate used.

~~7. A method according to claim 1, characterized in that the acid is selected from the group of sulphonic acids.~~

~~8.~~7. A method according to claim ~~7~~1, characterized in that the sulphonic acids are selected from methanesulphonic acid, p-toluenesulphonic acid.

~~9.~~8. A method according to claim 1, characterized in that olefin-containing mixtures are used as olefinically unsaturated compounds.

~~10.~~9. A method according to claim ~~9~~8, characterized in that the carbonylation is effected with isomerization to the n-terminal ester.

~~11.~~10. A method according to claim 1, characterized in that the olefinically unsaturated compounds comprise nitrogen and/or oxygen.

~~12.~~11. A method according to claim 1, characterized in that the palladium-containing compound with palladium in the oxidation states 0 to +II is selected from the group containing:
palladium halides,
palladium acetylacetonate,
palladium acetate,
palladium dibenzylideneacetone,
palladium triphenylphosphine.

~~13. A multiphasic reaction mixture containing:~~
~~i) at least one olefinically unsaturated compound, and~~
~~ii) at least one methyl ester,~~

characterized by a method according to claim 1.

14. A nonoic acid methyl ester mixture obtained by a method according to claim 1.