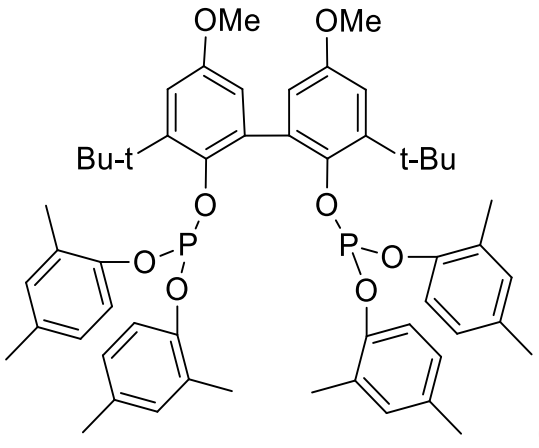
Claims

1. Method for preparing saturated C_n- and C_{2n}-alcohols where n = 5 comprising the method steps of
   a) providing a mixture of isomeric C_n-aldehydes where n = 5, wherein the proportion of unbranched aldehydes is at least 20% by weight, based on the C_n-aldehydes provided where n = 5,
   b) carrying out a distillation for the at least partial separation of the isomeric C_n aldehydes where n = 5 into a first stream having a higher proportion of linear aldehydes than the mixture provided in a) and into a second stream having a higher proportion of branched aldehydes than the mixture provided in a)
   c) carrying out an aldol condensation of the aldehydes present in the first stream having a higher proportion of linear aldehydes than the mixture provided in a) to obtain a mixture of C_n- and α,β–unsaturated C_{2n}-aldehydes
   d) mixing the mixture of C_n- and α,β–unsaturated C_{2n}-aldehydes obtained in c) with the second stream, provided in b), having a higher proportion of branched C_n aldehydes where n = 5 than the mixture provided in a)
   e) hydrogenating the mixture of C_n- and α,β–unsaturated C_{2n}-aldehydes and C_n-aldehydes where n = 5 obtained in d) with hydrogen to obtain a mixture of saturated C_n and C_{2n}-alcohols and
   f) separating the mixture of C_n and C_{2n}-alcohols.

2. Method according to Claim 1, wherein the C_n-aldehydes where n = 5 used in step a) were prepared by hydroformylation of isomeric olefins having 4 carbon atoms with synthesis gas in the presence of a hydroformylation catalyst to form the aldehydes specified.

3. Method according to Claim 2, wherein in the hydroformylation a catalyst system is used which comprises rhodium as central atom and is complexed with the ligand (1):



(1)

4. Method according to one or more of Claims 1 to 3, wherein the aldol condensation in step c) is carried out in the presence of aqueous sodium hydroxide solution.

5. Method according to one or more of Claims 1 to 4, wherein the aldol condensation of the C_n-aldehydes according to step c) is carried out in a tubular reactor which comprises at least one mixing module which disperses the reactant aldehyde into droplets having an average diameter (Sauter diameter) of 0.2 mm to 2 mm in the continuous catalyst phase (process liquor), which consists of aqueous sodium hydroxide solution and sodium salts of carboxylic acids and has a sodium content of 0.6 to 1.75% by mass and a pH in the range from 12.5 to 13.5.

6. Method according to one or more of Claims 1 to 5, wherein the aldol condensation of the C_n-aldehydes according to step c) is carried out in the temperature range from 100 to 150°C.

7. Method according to one or more of Claims 1 to 6, wherein the reaction pressure in the reactor during the aldol condensation of the C_n-aldehydes according to step c) is in the range from 0.2 to 1.0 MPa.

8. Method according to one or more of Claims 1 to 7, wherein the hydrogenation according to step e) is carried out in the temperature range from 170°C to 200°C at a pressure of $15*10^5$ Pa to $30*10^5$ Pa over a supported catalyst which contains at least nickel and copper as active components.

9. Method according to one or more of Claims 1 to 7, wherein the hydrogenation according to step e) is carried out with hydrogen in a pressure range from 5 to 100 bar and the hydrogenation temperatures are between 120 and 220°C.