include anhydrous sodium sulphate, anhydrous magnesium sulphate, molecular sieves (various pore sizes), calcium oxide, calcium chloride, potassium carbonate, oxazolidines, orthoesters of the general formula $RC(OR')_3$, aluminum oxide, silica gel, activated carbon, montmorillonite and mixtures thereof.

Definitions

The term "alkyl" when used herein, means, unless otherwise specified, C_1 to C_{12} alkyl and includes methyl, ethyl, propyl, butyl, pentyl, hexyl and heptyl groups, preferably, methyl, ethyl, propyl, butyl, pentyl and hexyl. Unless otherwise specified, alkyl groups may, when there is a sufficient number of carbon atoms, be linear or branched, be cyclic, acyclic or part cyclic/acyclic.

Preferably, the alkyl groups are linear.

The term "alkenyl" should be understood as "alkyl" above except at least one carbon carbon bond therein is unsaturated and accordingly the term relates to C_2 to C_{12} alkenyl groups.

The term "alk" or the like should, in the absence of information to the contrary, be taken to be in accordance with the above definition of "alkyl".

The term "aryl" when used herein includes five-to-ten-membered, preferably five to eight membered, carbocyclic aromatic or pseudo aromatic groups, such as phenyl, cyclopentadienyl and indenyl anions and naphthyl, which groups may be unsubstituted or substituted with one or more substituents selected from unsubstituted or substituted aryl, alkyl (which group may itself be unsubstituted or substituted

Claims

1. A process for the production of α,ß ethylenically unsaturated carboxylic acids or esters, by the liquid phase reaction of formaldehyde or a suitable source thereof with a non-cyclic carboxylic acid ester of formula $R^3-CH_2-COOR^4$ in the presence of a basic metal salt, wherein R^4 is an alkyl or cycloalkyl group, preferably a C_1 to C_4-alkyl group and R^3 is methyl wherein the basic metal salt is a group I or a group II metal salt.

2. The process according to claim 1, wherein the basic metal salt is selected from group I or group II metal oxides, hydroxides, carbonates, hydrogen carbonates, methyl carbonates, alkoxides, such as methoxides and t-butoxides, fluorides and phosphates.

3. The process according to any preceding claim, wherein the basic metal salt is selected from potassium oxide, caesium oxide, sodium oxide, rubidium oxide, barium oxide, potassium hydroxide, caesium hydroxide, sodium hydroxide, rubidium hydroxide, barium hydroxide, potassium phosphate, caesium phosphate, sodium phosphate, rubidium phosphate, barium phosphate, sodium methoxide, potassium methoxide, rubidium methoxide, sodium t-butoxide, potassium t-butoxide, rubidium t-butoxide, caesium t-butoxide, sodium fluoride, potassium fluoride, rubidium fluoride, caesium fluoride, potassium carbonate, caesium carbonate, sodium carbonate, rubidium carbonate, barium carbonate, potassium hydrogen carbonate, sodium hydrogen carbonate, rubidium hydrogen carbonate, caesium hydrogen carbonate, barium hydrogen carbonate, potassium methyl carbonate, sodium methyl carbonate, caesium methyl carbonate, rubidium methyl carbonate or barium methyl carbonate.

4. The process according to any preceding claim, wherein the reaction is performed at a temperature below about 300°C.

5. The process according to any preceding claim, wherein the reaction is performed at a pressure of between about 5 and 2000psi.

6. The process according to any preceding claim, wherein the suitable source of formaldehyde may be selected from formalin (formaldehyde, methanol, water), low molecular weight polyformaldehyde

(paraformaldehyde), gaseous formaldehyde, formaldehyde hemiacetal (alcoform), trioxane or anhydrous formaldehyde.

7. The process according to any preceding claim, wherein the process is a batch or continuous process.

8. The process according to any preceding claim, wherein in the reaction medium the non-cyclic carboxylic acid ester is maintained in a molar excess compared to the said formaldehyde or suitable source thereof.

9. The process according to claim 8, wherein the formaldehyde or suitable source thereof is added to the reactor at a rate from about 1 to 10 mol%/minute relative to the non-cyclic carboxylic acid ester.

10. The process according to claim 8 or 9, wherein the molar ratio of formaldehyde or suitable source thereof to the non-cyclic carboxylic acid ester is maintained at about 1:100 to 1:2, more preferably, about 1:50 to 1:5 during the reaction.

11. A process according to claim 8, wherein the formaldehyde or suitable source thereof is fed to the reactor in a molar ratio of 1.1:1 to 1:1 with the non-cyclic carboxylic acid ester.

12. A process according to any proceeding claim, wherein the process further comprises one or more solvents.

13. A process according to claim 12, wherein the solvent is wholly or substantially aprotic.

14. A process according to claim 13, wherein the solvent is an aprotic protophilic solvent or an aprotic photophobic solvent, more preferably, an aprotic protophilic solvent.

15. A process according to claim 14, wherein the solvent is selected from dimethyl formamide, diethyl formamide, dimethylacetamide(DMAc), 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone (DMPU), 1,3-dimethyl-2-imidazolidinone (DMEU or DMI), 3-methyl-2-oxazolidinone, propylene carbonate, diethylacetamide, 1-methyl-2-pyrrolidinone, hexamethylphosphoric triamide, pyridine, tetramethyl urea, dimethylsulfoxide, acetonitrile, propionitrile, benzonitrile, acetone,

2-butanone, 3-pentanone, acetophenone, nitromethane, nitrobenzene, tetrahydrothiophene 1,1-dioxide (sulfolane), diethyl ether, diisopropyl ether, 1,4-dioxane, dimethyl carbonate, tetrahydrofuran, 1,2-dimethoxyethane, diglyme, benzene, cyclohexane, xylene or toluene.

16. Use of a basic metal salt wherein the metal salt is a group I or group II metal salt, for the production of an α,β ethylenically unsaturated carboxylic acid or ester, by the liquid phase reaction of formaldehyde or a suitable source thereof with a non-cyclic carboxylic acid ester of formula R^3-CH_2-$COOR^4$, wherein R^4 is an alkyl or cycloalkyl group, preferably a C_1 to C_4-alkyl group and R^3 is methyl.