Claims

1. A process for the production of at least one of methyl acetate and acetic acid which process comprises contacting in a reactor a carbon monoxide-containing gas and a carbonylatable reactant selected from at least one of methanol and reactive derivatives thereof with a catalyst which comprises a mordenite loaded with copper and silver, the loading of the copper and silver being carried out by ion-exchange of part or all of the cation-exchangeable sites of the mordenite with copper and silver ions, to produce at least one of methyl acetate and acetic acid and subsequently regenerating the catalyst;~~.~~

~~2. A process according to claim 1~~ wherein the loading of copper and silver is carried out onto a mordenite which is in the ammonium form or in the proton form; and further

wherein the catalyst is regenerated by

(i) ceasing contact of the catalyst with the carbonylatable reactant and the carbon monoxide-containing gas;

(ii) optionally purging the reactor with an inert gas;

(iii) regenerating the catalyst with a regenerating gas comprising a molecular oxygen-containing gas and an inert diluent;

(iv) terminating the regeneration;

(v) optionally purging the reactor with an inert gas; and

(vi) resuming contact of the catalyst with the carbonylatable reactant, and a carbon monoxide-containing gas.

2~~3~~. A process according to claim 1 ~~or claim 2~~ wherein the loading of copper and silver onto mordenite is carried out by sequential ion-exchange.

3~~4~~. A process according to ~~any one of~~ claims ~~1 to 3~~ wherein the mordenite is loaded with copper in an amount in the range 5 to 30 mol% relative to aluminium and silver in an amount in the range 5 to 50 mol% relative to aluminium.

45. A process according to ~~any one of~~ claims ~~1 to 4~~ wherein the loading of copper and silver onto mordenite is carried out in accordance with the steps:

(1) contacting the mordenite with at least one aqueous solution of a metal salt selected from copper and/or silver salts until the mordenite is at or above its level of incipient wetness

(2) filtering the contacted mordenite to obtain a solid copper and/or silver loaded mordenite

(3) washing the copper and/or silver loaded mordenite with a solvent

(4) drying the washed copper and/or silver loaded mordenite

(5) where necessary, steps (1) to (5) are repeated so as to obtain a mordenite loaded with both copper and silver.

56. A process according to claim 45 wherein prior to filtering the contacted mordenite of step 2, the contacted mordenite is heated and wherein the dried catalyst of step 4 or step 5 is calcined.

~~7. A process according to any one of claims 1 to 6 wherein the catalyst is regenerated by~~

~~(i) ceasing contact of the catalyst with the carbonylatable reactant and the carbon monoxide-containing gas;~~

~~(ii) optionally purging the reactor with an inert gas;~~

~~(iii) regenerating the catalyst with a regenerating gas comprising a molecular oxygen-containing gas and an inert diluent;~~

~~(iv) terminating the regeneration;~~

~~(v) optionally purging the reactor with an inert gas; and~~

~~(vi) resuming contact of the catalyst with the carbonylatable reactant, and a carbon monoxide-containing gas.~~

68. A process according to claim 17 wherein the regeneration is carried out at 225 to 325 °C.

79. A process according to claim 17 ~~or claim 8~~ wherein the regenerating gas has a concentration of molecular oxygen-containing gas in the range 0.1 mol% to 25 mol% based on the total concentrations of the molecular oxygen-containing gas and the inert diluent.

810. A process for the production of at least one of methyl acetate and acetic acid which process comprises contacting in a reactor a carbon monoxide-containing gas and a carbonylatable reactant selected from at least one of methanol and reactive derivatives thereof with a catalyst which comprises a mordenite loaded with copper and silver, the loading of the copper and silver being carried out by ion-exchange of part or all of the cation-exchangeable sites of the mordenite with copper and silver ions, to produce at least one of methyl acetate and acetic acid and subsequently regenerating the catalyst~~according to claim 1~~;

wherein the regeneration is carried out by:

(a) ceasing contact of the catalyst with the carbonylatable reactant and optionally the carbon monoxide-containing gas;

(b) regenerating the catalyst with a regenerating gas selected from hydrogen or a mixture of hydrogen and carbon monoxide;

(c) terminating the regeneration; and

(d) resuming contact of the catalyst with the carbonylatable reactant and a carbon monoxide-containing gas.

911. A process according to ~~any one of~~ claims ~~1 to 10~~ wherein the regeneration is carried out in-situ.

1012. A process according to ~~any one of~~ claims ~~1 to 11~~ wherein the catalyst is subjected to one or more regenerations.

1113. A process according to ~~any one of~~ claims ~~1 to 12~~ wherein the carbonylatable reactant is dimethyl ether and water is present in gaseous carbonylatable reactant(s) in an amount of less than 2.5 wt%, relative to the amount of dimethyl ether.

12~~14~~. A process according to ~~any one of~~ claims ~~1 to 13~~ wherein the carbon monoxide-containing gas comprises carbon monoxide and hydrogen.

13~~15~~. A process according to ~~any one of~~ claims ~~1 to 14~~ wherein methyl acetate is a product and at least a portion of it is hydrolysed to acetic acid.

14. A process according to claim 8 wherein the loading of copper and silver is carried out onto a mordenite which is in the ammonium form or in the proton form.

15. A process according to claim 8 wherein the loading of copper and silver onto mordenite is carried out by sequential ion-exchange.

16. A process according to claim 8 wherein the mordenite is loaded with copper in an amount in the range 5 to 30 mol% relative to aluminium and silver in an amount in the range 5 to 50 mol% relative to aluminium.

17. A process according to claim 8 wherein the loading of copper and silver onto mordenite is carried out in accordance with the steps:

(1) contacting the mordenite with at least one aqueous solution of a metal salt selected from copper and/or silver salts until the mordenite is at or above its level of incipient wetness

(2) filtering the contacted mordenite to obtain a solid copper and/or silver loaded mordenite

(3) washing the copper and/or silver loaded mordenite with a solvent

(4) drying the washed copper and/or silver loaded mordenite

(5) where necessary, steps (1) to (5) are repeated so as to obtain a mordenite loaded with both copper and silver.

18. A process according to claim 17 wherein prior to filtering the contacted mordenite of step 2, the contacted mordenite is heated and wherein the dried catalyst of step 4 or step 5 is calcined.

19. A process according to claim 8 wherein the regeneration is carried out in-situ.

20. A process according to claim 8 wherein the catalyst is subjected to one or more regenerations.

21. A process according to claim 8 wherein the carbonylatable reactant is dimethyl ether and water is present in gaseous carbonylatable reactant(s) in an amount of less than 2.5 wt%, relative to the amount of dimethyl ether.

22. A process according to claim 8 wherein the carbon monoxide-containing gas comprises carbon monoxide and hydrogen.

23. A process according to claim 8 wherein methyl acetate is a product and at least a portion of it is hydrolysed to acetic acid.