Claims:

1. ~~An improved~~ process for the production of ethanol from ethanoic acid and H_2, characterised by the following steps:

1) introducing ethanoic acid, together with methanol and/or ethanol into an esterification reactor containing an esterification catalyst to produce methyl ethanoate and/or ethyl ethanoate,

2) introducing methyl ethanoate and/or ethyl ethanoate from step 1, together with H_2 and water, into a hydrogenation unit comprising a hydrogenation catalyst to produce a stream comprising ethanol, unreacted methyl ethanoate and/or ethyl ethanoate and optionally methanol,

3) separating the resulting stream, from step 2, into unreacted methyl ethanoate and/or ethyl ethanoate and ethanol and optionally methanol,

4) optionally reintroducing methyl ethanoate and/or ethyl ethanoate, from step 3, into the esterification reactor of step 1,

5) using at least a part of the methanol and/or the ethanol of step 3, as the methanol and/or ethanol feed of the esterification reactor of step 1, and

6) recovering ethanol, from step 3.

~~2. An improved process for the production of ethanol from methanol, characterised by the following steps:~~

~~1) introducing methanol, together with CO, into a carbonylation reactor, to produce ethanoic acid,~~

~~2) introducing ethanoic acid from step 1, together with methanol and/or ethanol, into an esterification reactor to produce methyl ethanoate and/or ethyl ethanoate,~~

~~3) introducing at least a part of the ethanoate from step 2, together with H_2 and water, into a hydrogenation unit to produce a stream comprising ethanol, unreacted ethanoate and optionally methanol,~~

~~4) separating the resulting stream, from step 3, into unreacted ethanoate and ethanol and optionally methanol,~~

~~5) optionally reintroducing ethanoate, from step 4, into the esterification reactor of step 2,~~

~~6) using at least a part of the methanol and/or the ethanol of step 4, as the methanol and/or ethanol feed of the esterification reactor of step 2, and~~

~~7) recovering ethanol, from step 4.~~

~~3. An improved process for the production of ethanol from a carbonaceous feedstock, whereby the carbonaceous feedstock is first converted into synthesis gas, which is subsequently converted into ethanol, characterised by the following consecutive steps:~~

~~1) introducing a carbonaceous feedstock, into a synthesis gas generation unit to produce synthesis gas,~~

~~2) introducing synthesis gas, produced in step 1, into a methanol synthesis reactor to produce methanol,~~

~~3) introducing methanol from step 2, together with CO, into a carbonylation reactor, to produce ethanoic acid,~~

~~4) introducing ethanoic acid from step 3, together with methanol and/or ethanol, into an esterification reactor to produce methyl ethanoate and/or ethyl ethanoate,~~

~~5) introducing ethanoate from step 4, together with H_2 and water, into a hydrogenation unit to produce a stream comprising ethanol, unreacted ethanoate and optionally methanol,~~

~~6) separating the resulting stream, from step 5, into unreacted ethanoate and ethanol and optionally methanol,~~

~~7) optionally reintroducing ethanoate, from step 6, into the esterification reactor of step 4,~~

~~8) using at least a part of the methanol and/or the ethanol of step 6, as the methanol and/or ethanol feed of the esterification reactor of step 4, and~~

~~9) recovering ethanol, from step 6.~~

~~4. An improved process according to any of claims 2 or 3 wherein the step of producing ethanoic acid by carbonylation of methanol comprises contacting methanol~~

~~with CO, in the liquid reaction composition, in a carbonylation reactor wherein, the liquid reaction composition comprises: (a) ethanoic acid, (b) an iridium catalyst, (c) methyl iodide, (d) water and (e) a promoter.~~

~~5. An improved process according to claim 4 wherein the promoter is selected from ruthenium and osmium.~~

~~6. An improved process according to claim 5 wherein the concentration of water in the liquid reaction composition of the carbonylation reactor is in the range 0.1 to 15 wt %, more preferably 1 to 10 wt %, most preferably 1 to 6.5 wt %.~~

2~~7~~. A~~n improved~~ process according to ~~any of the preceding~~ claims~~s~~ 1, wherein the molar ratio of the [methanol and ethanol] to ethanoic acid, introduced into the esterification reactor is ~~comprised~~ between 1.1 and 3~~, preferably 1.1 and 2~~.

3~~8~~. A~~n improved~~ process according to any of the preceding claims wherein the methyl ethanoate and/or ethyl ethanoate stream exiting the esterification reactor, which also contains unreacted ethanoic acid and residual esterification catalyst, is subjected to a purification step to remove said ethanoic acid and esterification catalyst before introduction into the hydrogenation unit.

4~~9~~. A~~n improved~~ process according to any of the preceding claims wherein water represents between 0.5 and 20 mol %~~, preferably between 0.5 and 15 mol % and most preferably between 1 and 5 mol %~~ of the total liquid feed (methyl ethanoate and/or ethyl ethanoate, alcohol and water) entering ~~into~~ the hydrogenation unit~~reactor~~.

5. A process according to claim 4, wherein water represents between 0.5 and 15 mol % of the total liquid feed (methyl ethanoate and/or ethyl ethanoate, alcohol and water) entering the hydrogenation unit.

6~~10~~. A~~n improved~~ process according to any of the preceding claims wherein the catalyst(s) employed in the hydrogenation unit is a copper-based catalyst.

7. A process according to any of the preceding claims wherein the catalyst(s) employed in the hydrogenation unit~~, more preferably~~ comprises~~ing~~ copper and zinc~~, most preferably consisting of copper-zinc-oxide~~.

~~11. An improved process according to any of the preceding claims, whereby when a copper based catalyst is employed in the hydrogenation unit(s), the feed mixture introduced into the hydrogenation reactor(s) is always above its dew point temperature.~~

8~~12~~. A~~n improved~~ process according to any of the preceding claims wherein the molar ratio of H_2 to [methyl ethanoate and ethyl ethanoate] that is introduced into the hydrogenation unit, is greater than 2:1~~, preferably the molar ratio is greater than 4:1 and most preferably the molar ratio is greater than 5:1~~; and is less than 100:1~~, preferably less than 50:1 and most preferably less than 15:1~~.

~~13. An improved process according to any of the preceding claims wherein the CO fed to the carbonylation reactor and the H_2 fed to the hydrogenation unit emanates from the separation of the synthesis gas produced in step 1 of claim 3.~~

9~~14~~. A~~n improved~~ process according to any of the preceding claims wherein a methyl ethanoate/methanol mixture is recovered from the ~~exit~~ stream exiting~~of~~ the hydrogenation unit and is recycled into the esterification reactor~~unit~~.

10~~15~~. A~~n improved~~ process according to any of the preceding claims wherein an ethyl ethanoate/ethanol mixture is recovered from the ~~exit~~ stream exiting~~of~~ the hydrogenation unit and is recycled into the esterification reactor~~unit~~.