the synthesis of methanol is achieved with a copper-based catalyst in a fixed bed reactor at 240-260°C and 5-10MPa.

At present, dimethyl ether can be prepared from synthesis gas with one step (using a bifunctional catalyst, methanol synthesis and methanol dehydration occur in one reactor) or can be synthesized by methanol dehydration. The synthesis gas may be prepared with non-petroleum energies, such as coal, biomass, natural gas, etc. If synthesizing ethanol at the same time of coproducing an amount of methanol can be achieved, methanol may not only be used as the final product, but also may be dehydrated to generate dimethyl ether. Dimethyl ether is carbonylated to generate methyl acetate, and methyl acetate is hydrogenated to generate the final product ethanol. The proportions of ethanol and methanol may be adjusted according to market demand to improve the flexibility of products and the operational motility of apparatuses, which has important realistic sense for developing new coal chemical industry. Therefore, a method for synthesizing ethanol and coproducing methanol under a co-feeding condition of synthesis gas and acetate is needed to be developed in the art.

SUMMARY

An object of this disclosure is to provide a method for producing ethanol and coproducing methanol using synthesis gas and acetate under a co-feeding condition.

Therefore, in an aspect, this disclosure provides a method for producing ethanol and coproducing methanol, comprising the step of passing a raw material gas containing an acetate and a synthesis gas through a reactor loaded with a catalyst to produce ethanol and coproduce methanol under the conditions of a reaction temperature of 150-350°C, a reaction pressure of 0.1-20.0 MPa, a reaction volume hourly space velocity of 100-45000 $mlg^{-1}h^{-1}$, and an acetate weight hourly space velocity of 0.01-5.0 h^{-1}; and the active components of the catalyst are copper and optionally zinc and/or aluminum, wherein the active component copper comprises 50.0wt% to less than 100.0 wt% of the total weight of the catalyst in terms of CuO; the active component zinc comprises more than 0 wt% to 35.0 wt% of the total weight of the catalyst in terms of ZnO; and the active component aluminum comprises more than 0 wt% to 10 wt% of the total weight of the catalyst in terms of Al_2O_3.

In one preferred embodiment, the acetate is methyl acetate and/or ethyl acetate.

In one preferred embodiment, in the catalyst, the active component copper comprises 50.0-100.0 wt% of the total weight of the catalyst in terms of CuO; the active component zinc comprises 0-35.0 wt% of the total weight of the catalyst in terms of ZnO; and the active

WHAT IS CLAIMED IS:

1. A method for producing ethanol and coproducing methanol, comprising the step of passing a raw material gas containing an acetate and a synthesis gas through a reactor loaded with a catalyst to produce ethanol and coproduce methanol under the conditions of a reaction temperature of 150-350°C, a reaction pressure of 0.1-20.0 MPa, a reaction volume hourly space velocity of 100-45000 $mlg^{-1}h^{-1}$, and an acetate weight hourly space velocity of 0.01-5.0 h^{-1}; and the active components of the catalyst are copper, zinc and aluminum, wherein the active component copper comprises 50.0wt% to less than 100.0 wt% of the total weight of the catalyst in terms of CuO; the active component zinc comprises more than 0 wt% to 35.0 wt% of the total weight of the catalyst in terms of ZnO; and the active component aluminum comprises more than 0 wt% to 10 wt% of the total weight of the catalyst in terms of Al_2O_3.

2. The method according to claim 1, wherein the acetate is methyl acetate and/or ethyl acetate.

3. The method according to claim 1, wherein the catalyst further contains one or more of manganese, molybdenum, zirconium, chromium, iron, barium, magnesium, nickel, and calcium as a promoter.

4. The method according to claim 3, wherein the promoter comprises more than 0 wt% to 5.0 wt% of the total weight of the catalyst in terms of the metal oxide thereof.

5. The method according to claim 1, wherein the catalyst is subjected to reduction treatment with hydrogen gas and/or a synthesis gas before use.

6. The method according to claim 1, wherein the molar ratio of synthesis gas/acetate in the raw material gas is 10-101/0.1-4, and the molar ratio of hydrogen gas/carbon monoxide in the synthesis gas is 9-100/1.

7. The method according to claim 1, wherein the molar ratio of synthesis gas/acetate in the raw material gas is 21-101/2-4, and the molar ratio of hydrogen gas/carbon monoxide in the synthesis gas is 20-100/1.

8. The method according to claim 1, wherein the reaction temperature is 180-300°C, the reaction pressure is 1.0-10.0 MPa, the reaction volume hourly space velocity is 400-35000 $mlg^{-1}h^{-1}$, and the acetate weight hourly space velocity is 0.1-3.0 h^{-1}.