

Claims

1. A fluidized bed reactor, comprising an inlet zone at a lower position, an outlet zone at an upper position, and a reaction zone between the inlet zone and the outlet zone,
5 wherein

a guide plate is disposed in the reaction zone, comprising a dense channel region in an intermediate region thereof and a sparse channel region disposed on a periphery thereof encompassing the dense channel region,

an inlet for accelerating gas is disposed in the outlet zone of the fluidized bed reactor.

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2. The fluidized bed reactor according to claim 1, wherein the dense channel region and the sparse channel region each comprise a circular plate having evenly distributed pores, or a plurality of concentric ring shaped sloping panels spaced apart, or a plurality of straight panels spaced apart in parallel.

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3. The fluidized bed reactor according to claim 1, wherein a dimension of a channel in the dense channel region is smaller than that of a channel in the sparse channel region.

4. The fluidized bed reactor according to claim 3, where a ratio of the dimension of the channel in the dense channel region to that of the channel in the sparse channel region is in a range of 1:4 to 2:3.

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5. The fluidized bed reactor according to claim 4, wherein the dimension of the channel in the dense channel region is in a range of 0.01m to 0.08m.

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6. The fluidized bed reactor according to claim 1, wherein the dense channel region is round shaped and the sparse channel region is annular ring shaped, and

a ratio of a diameter of the dense channel region to a width of the sparse channel region is in a range of 2:1 to 9:1.

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7. The fluidized bed reactor according to claim 1, wherein a plurality of guide plates is provided, which are distributed along an axial direction of the fluidized bed reactor.

8. The fluidized bed reactor according to claim 1, wherein the inlet for accelerating

gas is configured to extend obliquely from a lower position to an upper position.

9. A reaction regeneration apparatus, comprising (i) a fluidized bed reactor comprising an inlet zone at a lower position, an outlet zone at an upper position, and a
 5 reaction zone between the inlet zone and the outlet zone, wherein a guide plate is disposed in the reaction zone, comprising a dense channel region in an intermediate region thereof and a sparse channel region disposed on a periphery thereof encompassing the dense channel region and (ii) separation device and a catalyst regeneration device respectively connected with the fluidized bed reactor, wherein

10 the separation device comprises a preliminary gas-solid separator communicated with an outlet zone of the fluidized bed reactor; a vertically arranged damper, a lower region of the damper being communicated with a solid outlet of the preliminary gas-solid separator for collecting catalyst particles, and an upper region of the damper being communicated with a gas outlet of the preliminary gas-solid separator; and a fine gas-solid separator, an
 15 inlet of the fine gas-solid separator being communicated with the upper region of the damper and a solid outlet thereof being communicated with the lower region of the damper, and

the catalyst regeneration device comprises a feed zone at a lower position and a discharge zone at an upper position, the feed zone being arranged lower than the lower
 20 region of the damper, and the discharge zone being arranged higher than the inlet zone of the fluidized bed reactor, wherein

the lower region of the damper is communicated with the feed zone of the catalyst regeneration device through a second pipe, and the discharge zone of the catalyst regeneration device is communicated with the inlet zone of the fluidized bed reactor
 25 through a third pipe.

10. The reaction regeneration apparatus according to claim 9, wherein a diameter of the upper region of the damper is smaller than that of the lower region thereof.

30 11. The reaction regeneration apparatus according to claim 9, wherein both the preliminary gas-solid separator and the fine gas-solid separator are cyclone separators.

12. The reaction regeneration apparatus according to claim 9, wherein the preliminary gas-solid separator is a cyclone separator, and the fine gas-solid separator

comprises two- or multi-stage series cyclone separators, wherein

the two or multi-stage series cyclone separators are configured so that an inlet of a first stage cyclone separator is communicated with the upper region of the damper, gas product being obtained from a gas outlet of a last stage cyclone separator, a gas outlet of
5 an upstream cyclone separator is communicated with an inlet of an adjacent downstream cyclone separator, and solid outlets of all the cyclone separators are communicated with the lower region of the damper.

13. The reaction regeneration apparatus according to claim 9, wherein the lower
10 region of the damper is configured and arranged so that it performs a stream stripping operation.

14. The reaction regeneration apparatus according to claim 9, wherein the third pipe is provided with a flow blocking member at a top of an inner wall thereof.

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15. The reaction regeneration apparatus according to claim 14, wherein the flow blocking member is a baffle tilting towards the fluidized bed reactor.

16. The reaction regeneration apparatus according to claim 15, wherein a plurality of
20 baffles is provided, which is arranged in parallel with respect to one another.

17. The reaction regeneration apparatus according to claim 14, wherein the flow blocking member is a stop pawl protruding radially inward.

25 18. The reaction regeneration apparatus according to claim 17, wherein a plurality of stop pawls is provided, which is arranged in a row along an axis of the third pipe.

19. The reaction regeneration apparatus according to claim 18, wherein a ratio of a length of each stop pawl to a diameter of the third pipe is in a range of 0.1 to 0.5.

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20. The reaction regeneration apparatus according to claim 9, wherein the inlet zone of the fluidized bed reactor is disposed lower than the lower region of the damper of the separation device, and the lower region of the damper is communicated with the inlet zone of the fluidized bed reactor through a first pipe.

21. A process for preparing olefins, using a reaction regeneration apparatus according to claim 9, wherein an inlet zone of a fluidized bed reactor is disposed lower than a lower region of a damper of a separation device, and the lower region of the damper is
5 communicated with the inlet zone of the fluidized bed reactor through a first pipe,
wherein the process comprises:
reacting gaseous raw material containing oxygenates with catalysts in a reaction zone of the fluidized bed reactor,
feeding product obtained and entrained catalysts into the separation device through
10 an outlet zone of the fluidized bed reactor,
separating the product from the entrained catalysts through the separation device, feeding a portion of catalysts obtained from the separation directly into the inlet zone of the fluidized bed reactor, subsequently regenerating rest catalysts, wherein the rest catalysts are the portion of catalysts obtained from the separation which are regenerated
15 and fed into the inlet zone of the fluidized bed reactor, and feeding regenerated catalysts into the inlet zone of the fluidized bed reactor, and
mixing non-regenerated catalysts and the regenerated catalysts in the inlet zone of the fluidized bed reactor, and then feeding mixed catalysts into the reaction zone of the fluidized bed reactor.
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22. The process according to claim 21, wherein a weight ratio of the non-regenerated catalysts to the regenerated catalysts is in a range of 0.3 to 1.5.
23. The process according to claim 21, wherein an operation of the separation device
25 comprises:
preliminarily separating product from the fluidized bed reactor having catalysts entrained therein through a preliminary gas-solid separator,
feeding product obtained from the preliminary separation entraining the rest catalysts into an upper region of the damper,
30 leading the gas product out of the damper, and feeding it into a fine gas-solid separator for fine separation, and
obtaining the final gas product from a gas outlet of the fine gas-solid separator, and gathering catalysts from the preliminary gas-solid separator and the fine gas-solid separator into the lower region of the damper.

24. The process according to claim 23, wherein water vapor is fed into the damper from a lower end thereof, so that product entrained in the catalysts is separated from the catalysts.

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25. The process according to claim 21, wherein a pressure in the fluidized bed reactor by gage pressure is in a range of 0-0.4 MPa, an average temperature therein is in a range of 380-550 °C, and a mean density in the reaction zone is in a range of 40-200 KG/m³, and

the catalyst used therein is SAPO-34, wherein a catalyst regeneration medium is air
10 and a regeneration temperature is in a range of 600-700 °C.

26. The process according to claim 25, wherein an inlet for accelerating gas is disposed in the outlet zone of the fluidized bed reactor, and gas flowing into the outlet zone of the fluidized bed reactor through the inlet for accelerating gas is water vapor or
15 nitrogen, a linear speed of the gas being in a range of 1.0-10.0m/s.

27. The process according to claim 21, wherein a ratio of a pressure drop generated when the gaseous raw material flows through the dense channel region to that generated when the gaseous raw material flows through the sparse channel region is in a range of
20 1.2:1 to 10:1.

28. The process according to claim 21, wherein the oxygenates comprise one or more selected from a group consisting of methanol, ethanol, n-propyl alcohol, isopropyl alcohol, C4-C20 alcohol, ethyl methyl ether, dimethyl ether, diethyl ether, diisopropyl ether,
25 methanal, dimethyl carbonate, acetone, and acetic acid, and a weight of the oxygenates accounts for 10% to 100% of the raw material.

29. A process for preparing aromatic hydrocarbons, using a reaction regeneration apparatus according to claim 9, wherein

30 the process comprises:

reacting raw material containing oxygenates with catalysts in a reaction zone of a fluidized bed reactor,

feeding product obtained and catalysts entrained therein into a separation device through an outlet zone of the fluidized bed reactor, and

separating the product from the catalysts entrained therein in the separation device, regenerating the catalysts obtained from the separation, and feeding regenerated catalysts into the inlet zone of the fluidized bed reactor, and subsequently into the reaction zone of the fluidized bed reactor.

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30. The process according to claim 29, wherein an operation of the separation device comprises:

preliminarily separating product from the fluidized bed reactor having catalysts entrained therein through a preliminary gas-solid separator,

10 feeding product obtained from the preliminary separation entraining rest catalysts into an upper region of the damper, wherein the rest catalysts are the portion of catalysts which are not separated by the preliminary gas-solid separator,

leading the product out of the damper, and feeding the product into a fine gas-solid separator for fine separation, and

15 obtaining the final product from a gas outlet of the fine gas-solid separator, and gathering catalysts from the preliminary gas-solid separator and the fine gas-solid separator into the lower region of the damper.

20 31. The process according to claim 30, wherein water vapor is fed into the damper from a lower end thereof, so that product entrained in the catalysts is separated from the catalysts.

25 32. The process according to claim 29, wherein a pressure in the fluidized bed reactor by gage pressure is in a range of 0-0.6 MPa, an average temperature therein is in a range of 440-550 °C, a space velocity in the reaction zone is in a range of 0.3-5 h⁻¹, and a mean density in the reaction zone is in a range of 200-450 kg/m³, and

the catalyst used therein is ZSM-5, wherein a catalyst regeneration medium being air and a regeneration temperature being in a range of 550-650 °C.

30 33. The process according to claim 32, wherein an inlet for accelerating gas is disposed in the outlet zone of the fluidized bed reactor, and gas flowing into the outlet zone of the fluidized bed reactor through the inlet for accelerating gas is water vapor or nitrogen, a linear speed of the gas being in a range of 1.0-10.0 m/s.

34. The process according to claim 29, wherein a ratio of a pressure drop generated when the gaseous raw material flows through the dense channel region to that generated when the gaseous raw material flows through the sparse channel region is in a range of 1.2:1 to 10:1.

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35. The process according to claim 29, wherein the oxygenates comprise one or more selected from a group consisting of methanol, ethanol, n-propyl alcohol, isopropyl alcohol, C4-C20 alcohol, ethyl methyl ether, dimethyl ether, diethyl ether, diisopropyl ether, methanal, dimethyl carbonate, acetone, and acetic acid, and a weight of the oxygenates
10 accounts for 10% to 100% of the raw material.