

Claims

1. Use of a particulate catalyst containing 60.0 to 99.5 wt.% ZrO_2 stabilised with an oxide of the element Hf and at least one oxide of the element M, wherein $M = \text{Ce}, \text{Si}, \text{Ti}$ or Y , for the hydrolysis
5 reaction of methionine amide to methionine, wherein the median particle size x_{50} of the particulate catalyst is in the range of from 0.8 to 9.0 μm , preferably of from 1.0 to 7.0 μm .
2. Use according to claim 1, characterised in that the element $M = \text{Si}, \text{Ti}$ or Y , preferably Si or Y .
3. Use according to claim 1 or 2, characterised in that the particle size x_{10} of the particulate catalyst
10 is in the range of from 0.5 to 8.0 μm , preferably of from 0.8 to 6.5 μm , and the particle size x_{90} of the particulate catalyst is in the range of from 1.0 to 11.0 μm , preferably of from 1.3 to 8.0 μm .
4. Use according to any one of claims 1 to 3, characterised in that the catalyst comprises 0.1 to 40 wt.% of oxides of the elements Hf, Ce, Si, Ti and Y.
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5. Use according to any one of claim 1 to 4, characterised in that the catalyst comprises 0.5 to 3.0 wt.% HfO_2 and 0.1 to 40 wt.% TiO_2 and/or 0.2 to 6 wt.% SiO_2 and/or 3 to 10 wt.% Y_2O_3 and/or 5 to 25 wt.% CeO_2 .
- 20 6. Use according to any one of claims 1 to 5, characterised in that the catalyst has a BET surface area of from 30 to 250 m^2/g , preferably of from 50 to 160 m^2/g , preferably of from 55 to 145 m^2/g .
7. Use according to any one of claims 1 to 6, characterised in that the catalyst has an average pore volume of from 0.20 to 0.50 mL/g and preferably of from 0.24 to 0.49 mL/g .
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8. Use according to any one of claims 1 to 7, characterised in that the catalyst has a median pore diameter of from 20 to 200 nm, preferably of from 23 to 160 nm.
9. Use according to any one of claims 1 to 8, characterised in that the catalyst comprises triclinic or
30 monoclinic ZrO_2 .
10. Use according to any one of claims 1 to 9, characterised in that the catalyst contains an additional inactive component as carrier and/or binder material, preferably Al_2O_3 .
- 35 11. Use according to any one of claims 1 to 10, characterised in that the particulate catalyst is present in a shaped form, preferably as granulate, extrudate, pellet or pressed product.
12. A process for preparing methionine comprising a step of contacting a solution or suspension comprising methionine amide and water with a catalyst having the features as defined in any one of
40 claims 1 to 10 to provide a reaction mixture comprising methionine.

13. The process according to claim 12, characterised in that said solution or suspension is contacted with said catalyst at a temperature of from 70 to 200°C, preferably of from 80 to 180°C, particularly preferably of from 90 to 160°C and very particularly preferably of from 100 to 150°C .
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14. The process according to one of claims 12 to 13, characterised in that said solution or suspension is used in a start concentration of from 1 to 30 wt.% methionine amide, preferably 2 to 24 wt.%, particularly preferably 3 to 20 wt.%.
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15. The process according to any one of claims 12 to 14, characterised in that said solution or suspension contains one or more ketone compound in a concentration of 0,1 to 2 moleq, preferably 0,5 to 1.5 moleq relative to the methionine amide concentration in said solution or suspension.
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16. The process according to any one of claims 12 to 15, characterised in that said solution or suspension contains an alkali metal or alkaline earth metal hydroxide in a concentration of 0,01 to 0.5 moleq, preferably 0,03 to 0.2 moleq, particularly preferably 0,05 to 0.1 moleq relative to the methionine amide concentration in said solution or suspension.
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17. The process according to any one of claims 12 to 16, characterised in that said solution or suspension contains NH_3 in a concentration of 0 to 10 moleq, preferably 0,1 to 7 moleq relative to the methionine amide concentration in said solution or suspension.
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18. The process according to any one of claims 12 to 17, characterised in that the reaction is carried out in a continuous mode employing the catalyst in a fixed-bed type or trickle-bed type reactor.
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19. The process according to any one of claims 12 to 18, characterised in that the reaction is carried out in a continuous mode with a weight-hourly-space-velocity (WHSV) rate of 0.0001 to 10, preferably 0.001 to 5, more preferably 0.01 to 1 and most preferably 0.025 to 0.1 g(methionine amide)/h/g(catalyst).
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20. The process according to any one of claims 12 to 19, characterised in that the reaction is carried out in a batch mode and the catalyst is used in an amount of from 0.01 to 5 moleq ZrO_2 per mol methionine amide, preferably 0.05 to 2 moleq and particularly preferably 0.15 to 0.6 moleq.
21. A process for preparing methionine comprising the following steps:
- a. reacting methylmercaptopropionaldehyde with hydrocyanic acid and ammonia or reacting 2-hydroxy-4-(methylthio)butyronitrile with ammonia to provide a reaction mixture containing methionine nitrile,

- b. optionally separation of all or a part of residual ammonia from the reaction mixture of step a.,
- c. hydrolysing the reaction mixture obtained in step a. or b. in the presence of a carbonyl catalyst and a base catalyst and water or in the presence of a CeO₂ containing catalyst and water to provide a solution or suspension comprising methionine amide or a mixture of methionine amide and methionine,
- d. optionally separating all or a part of the residual ammonia or residual ammonia and carbonyl catalyst from the solution or suspension of step c.,
- e. preparing methionine by contacting the solution or suspension obtained from step c. or d. and water with a catalyst having the features as defined in any one of claims 1 to 10.
- f. optionally separating all or a part of the residual ammonia or residual ammonia and carbonyl catalyst from the solution or suspension of step e., preferably by distillation, to obtain a reaction liquid containing methionine and potentially some unreacted methionine amide,
- g. isolation of methionine by crystallisation and optionally subsequent re-crystallisation from the methionine containing reaction liquid obtained from step f. and obtaining a mother liquor
- h. optionally recycling the mother liquor from step g. to step e. to complete the reaction of potentially unreacted methionine amide.