on account of the synthesis times, which are proportionately longer the higher the desired mesoporosity.

[0016] The main references for post-treatments are discussed below. Document US 2013/0 183 229 introduces an amount of Pluronic® of the same order of magnitude as the amount of zeolite X, and performs long, liquid-route treatments followed by several calcination treatments, whereas document WO 2013/106 816 introduces treatments with a cetyltrimethylammonium (CTA) halide coupled with an acid. The publication by J. Pérez-Ramírez *et al. (ibid.)* describes post-treatments that are optimized for zeolites X and LTA with, first, a treatment with the acid H_4EDTA followed by an NaOH basic treatment and finally a further treatment with acidic Na_2H_2EDTA.

[0017] Although these processes make it possible to prepare hierarchically porous zeolites, as shown by the shape of the nitrogen adsorption isotherms of the solids obtained, it is important to note that these processes use amounts of complexing agent of the same order of magnitude as the initial mass of zeolite with numerous long operations. Furthermore, the mass yield of these processes is less than 60%, which further penalizes their production efficiency. These processes are therefore long, expensive and relatively unproductive. Furthermore, the micropore volumes are greatly reduced by the various treatments.

[0018] The inventors have now discovered that the problems encountered in the prior art can be totally or at least partially solved by means of the hierarchically porous zeolites according to the present disclosure.

[0019] In particular, one aim of the present disclosure consists in providing hierarchically porous zeolites combining a high micropore volume, optimal purities and adjustable crystal sizes. Another aim of the present disclosure consists in providing a process that is economical, simple and readily industrializable for the preparation of the said zeolites.

[0020] Thus, there is provided a hierarchically porous zeolite having at least the following characteristics:

- Si/Al mole ratio of between 1 and 1.4, limits inclusive,
- a numerical mean diameter of the crystals of between 0.1 μm and 20 μm, preferably between 0.1 μm and 10 μm, more preferably between 0.5 μm and 10 μm, and more preferentially between 0.5 μm and 5 μm, limits inclusive,
- controlled and optimal crystallinity, and

- mesoporosity such that the mesoporous outer surface area is between 40 $m^2.g^{-1}$ and 400 $m^2.g^{-1}$, and preferably between 60 $m^2.g^{-1}$ and 200 $m^2.g^{-1}$.

[0020a] In an aspect, there is provided a hierarchically porous zeolite of Faujasite (FAU) or Zeolite A (LTA) type, having at least the following characteristics:

- Si/Al mole ratio of between 1 and 1.4, limits inclusive,
- a numerical mean diameter of the crystals of between 0.1 µm and 20 µm, preferably between 0.1 µm and 10 µm, more preferably between 0.5 µm and 10 µm, and more preferentially between 0.5 µm and 5 µm, limits inclusive,
- a pure zeolite phase, and moreover a micropore volume Vµp which satisfies the equation $V\mu p = V\mu p_R \pm 15\%$, preferably the equation $V\mu p = V\mu p_R \pm 10\%$, and more preferentially the equation $V\mu p = V\mu p_R \pm 5\%$, where $V\mu p_R$ represents the micropore volume measured, under the same conditions, for a zeolite of the same chemical nature and of the same crystal structure, but not mesoporous within the meaning of the invention, i.e. whose mesopore outer surface area is strictly less than 40 $m^2.g^{-1}$, and
- mesoporosity such that the mesoporous outer surface area is between 40 $m^2.g^{-1}$ and 400$m^2.g^{-1}$, and preferably between 60 $m^2.g^{-1}$ and 200 $m^2.g^{-1}$.

[0020b] In another aspect, there is provided a process for preparing a zeolite as defined above, comprising at least the following steps:

a) preparation of a "growth" gel, by mixing a source of silica with a source of alumina, at a temperature of between 0°C and 60°C,

b) addition to the growth gel of step a) of a nucleating agent, at a temperature of between 0°C and 60°C,

c) addition to the reaction medium of at least one structuring agent,

d) crystallization reaction by increasing the temperature,

e) filtration and washing of the zeolite crystals obtained, and

f) drying and calcination.

CLAIMS

1. Hierarchically porous zeolite of Faujasite (FAU) or Zeolite A (LTA) type, having at least the following characteristics:

- Si/Al mole ratio of between 1 and 1.4, limits inclusive,
- a numerical mean diameter of the crystals of between 0.1 μm and 20 μm, preferably between 0.1 μm and 10 μm, more preferably between 0.5 μm and 10 μm, and more preferentially between 0.5 μm and 5 μm, limits inclusive,
- a pure zeolite phase, and moreover a micropore volume Vμp which satisfies the equation $V\mu p = V\mu p_R \pm 15\%$, preferably the equation $V\mu p = V\mu p_R \pm 10\%$, and more preferentially the equation $V\mu p = V\mu p_R \pm 5\%$, where $V\mu p_R$ represents the micropore volume measured, under the same conditions, for a zeolite of the same chemical nature and of the same crystal structure, but not mesoporous within the meaning of the invention, i.e. whose mesopore outer surface area is strictly less than 40 $m^2.g^{-1}$, and
- mesoporosity such that the mesoporous outer surface area is between 40 $m^2.g^{-1}$ and 400$m^2.g^{-1}$, and preferably between 60 $m^2.g^{-1}$ and 200 $m^2.g^{-1}$.

2. Zeolite according to Claim 1, which is a zeolite of FAU type, and especially a zeolite X, MSX or LSX or a zeolite EMT or alternatively a zeolite LTA.

3. Process for preparing a zeolite according to any one of the preceding claims, comprising at least the following steps:

a) preparation of a "growth" gel, by mixing a source of silica with a source of alumina, at a temperature of between 0°C and 60°C,

b) addition to the growth gel of step a) of a nucleating agent, at a temperature of between 0°C and 60°C,

c) addition to the reaction medium of at least one structuring agent,

d) crystallization reaction by increasing the temperature,

e) filtration and washing of the zeolite crystals obtained, and

f) drying and calcination.

4. Process according to Claim 3, in which the nucleating agent is a nucleating gel.

5. Process according to Claim 4, in which the amount of nucleating gel added is between 0.1% and 20%, preferably between 0.5% and 15% by weight and more preferably between 1% and 10% by weight, limits inclusive, relative to the weight of the growth gel.

6. Process according to Claim 3, in which the nucleating agent is a crystal.

7. Process according to Claim 6, in which the amount of crystal added is between 0.1% and 10% by weight relative to the total weight of growth gel.

8. Process according to any one of Claims 3 to 7, in which the source of silica is sodium silicate and the source of alumina is alumina trihydrate.

9. Process according to any one of Claims 3 to 8, in which the structuring agent is an organosilane.

10. Process according to any one of Claims 3 to 9, in which the structuring agent is chosen from [3-(trimethoxysilyl)propyl]octadecyldimethylammonium chloride, [3-(trimethoxysilyl)propyl]hexadecyldimethylammonium chloride, [3-(trimethoxysilyl)propyl]dodecyldimethylammonium chloride, [3-(trimethoxysilyl)propyl]octylammonium chloride, N-[3-(trimethoxysilyl)propyl]aniline, 3-[2-(2-aminoethylamino)ethylamino]propyltrimethoxysilane, N-[3-(trimethoxysilyl)propyl]-N'-(4-vinylbenzyl)ethylenediamine, triethoxy-3-(2-imidazolin-1-yl)propylsilane, 1-[3-(trimethoxysilyl)propyl]urea, N-[3-(trimethoxysilyl)propyl]ethylenediamine, [3-(diethylamino)propyl]trimethoxysilane, (3-glycidyloxypropyl)trimethoxysilane, 3-(trimethoxysilyl)propyl methacrylate, [2-(cyclohexenyl)ethyl]triethoxysilane, dodecyltriethoxysilane, hexadecyltrimethoxysilane, (3-aminopropyl)trimethoxysilane, (3-mercaptopropyl)trimethoxysilane, (3-chloropropyl)trimethoxysilane, and also mixtures of two or more thereof in all proportions.

11. Process according to any one of Claims 3 to 10, in which the amount of structuring agent(s) is such that the structuring agent(s)/starting/Al_2O_3 mole ratio is