removed either by calcination or by dissolution to generate the mesoporosity (C. J. H. Jacobsen, *J. Am. Chem. Soc.*, (2000), ***122***, 7116-7117).

- Zeolitization of amorphous mesoporous solids such as mesoporous silicas formed according to the sol-gel technique described by M. Matsukata et al., (*Top. Catal.*, (1999), ***9***, 77-92).
- Direct synthesis mentioned at the start using a structuring agent of organosilane type, this type of structuring agent having the particular feature of having, on the one hand, affinity with the silico-alumina species which form the zeolite network by virtue of its silane function, and, on the other hand, of being able to occupy a space with its long-chain organic function which serves to occupy the space and to create mesoporosity when it is removed (patent application WO 2007/043 731).

[0006] However, even though the solids obtained according to this direct synthetic process do indeed have hierarchical porosity as shown by the nitrogen adsorption isotherms and the transmission microscopy photos (A. Inayat *et al.*, *Angew. Chem. Int. Ed.*, (2012), ***51***, 1962-1965), it is observed that:

- the micropore volume of these hierarchically porous zeolites is significantly lower than that of non-mesoporous zeolites,
- ~~the structuring agent modifies the growth rates of the crystal faces, which does not~~ allow the size of the crystals to be correctly controlled,
- the increase in content of structuring agent directed towards increasing the mesopore volume leads to a loss of selectivity for the crystallization of a given zeolite, which results in the formation of an unwanted mixture of zeolite structures (Y. Meng *et al.*, *Asian Journal of Chemistry*, ***25*** (8), (2013), 4423-4426).

[0007] One of the objects of the ~~present invention~~embodiments disclosed herein is to solve at least these three major drawbacks noted for direct synthesis using a structuring agent of organosilane type.

[0008] Mention may also be made of the following documents, in which the use of structuring agents of organosilane type, and of organosilane derivatives, is described, for the purpose of synthesizing various hierarchically porous zeolite structures including zeolites X and LTA.

[0009] Thus, R. Ryoo (*Nature Materials*, (2006), vol. 5, p. 718 sqq.) describes the synthesis of LTA having mesoporosity and, later, (K. Cho *et al.*, *Chem. Mater.*, ***21***, (2009), 5664-5673) the synthesis of mesoporous zeolites of LTA type and applications thereof in catalysis. The diffractograms presented in Figure 2 of the article by K. Cho (see *above*) show that there is no contaminating crystalline phase. On the other hand, the decrease in

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~~invention~~.

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

[0020] Thus, ~~and according to a first aspect, the present invention relates to~~in an aspect, 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 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.