SMS1471-74 that is appropriate for agglomerates having a size that is less than 1.6 mm, is greater than or equal to 2 MPa.

The French patent FR2925367 describes a manufacturing process for manufacturing agglomerated zeolitic adsorbents that comprises a mixture of zeolite X crystals exchanged to at least 90% by barium ions alone or by barium ions and potassium ions, it being possible for the exchangeable sites occupied by the potassium to represent up to one third of the exchangeable sites occupied by the barium + potassium ions (any possible balance generally being made up by alkali or alkaline-earth ions other than barium and potassium); LSX zeolite crystals exchanged to at least 90% by barium ions alone, or by barium ions and potassium ions, it being possible for the exchangeable sites occupied by potassium to represent up to one third of the exchangeable sites occupied by barium + potassium ions (any possible balance generally being made up by alkali or alkaline-earth ions other than barium and potassium); and a binder in a proportion less than or equal to 20% by weight of the total mass of the agglomerate.

The patent US6410815 teaches that the performance levels of the industrial separation process for separating para-xylene depend to a large extent on: the adsorbent, its adsorption capacity, and the degree of selectivity it exhibits for para-xylene in a medium constituted of C_8 aromatic compounds, typically *para*-xylene, *meta*-xylene, *ortho*-xylene, ethylbenzene; as well on the other hand, on the ability of the desorbents, such as toluene and para-diethylbenzene, to desorb the adsorbed *para*-xylene. The selectivity $\alpha_{A/B}$ of the adsorbent for a component A relative to a compound B is defined as the ratio of the concentrations of the compounds in the adsorbed phase divided by the ratio of the concentrations of the compounds in the non-adsorbed phase at equilibrium:

$$a_{A/B} = A_{ads}/B_{ads} \times B_{liq}/A_{liq}$$

where A_{ads} and B_{ads} are the concentrations of compound A and compound B in the adsorbed phase respectively and A_{liq} and B_{liq} are the concentrations of compound A and compound B in the fluid phase.

Summary

In a surprising manner, it appears that agglomerated zeolitic adsorbents comprising a Faujasite-type zeolite having a controlled silicon to aluminium Si/Al molar ratio and in particular a Si/Al molar ratio such that $1.10 \leq Si/Al \leq 1.18$, preferably $1.10 \leq Si/Al \leq 1.17$, even more preferably $1.10 \leq Si/Al \leq 1.16$, even more preferably $1.11 \leq Si/Al \leq 1.16$ (to be referred to as MSX, abbreviation for Medium Silica X or in French: *zéolithe X à teneur moyenne en silice*) that are exchanged to at least 90% by barium ions alone or by barium ions and potassium ions, can advantageously replace the zeolitic adsorbents described in the literature which are

based on zeolite X and/or based on zeolite LSX, alone or in mixtures and exchanged with barium or exchanged with barium and potassium. The agglomerated zeolitic adsorbents according to the disclosure show in particular unexpected levels of performance in terms of selectivity, in a *para*-xylene separation process. For obvious reasons of ease of implementation and industrial exploitation, the agglomerated zeolitic adsorbents that may be used in the context of the process of the present disclosure, are used alone, preferably without any other zeolitic adsorbent(s), whether in layers or in mixtures.

The disclosure, in one aspect, relates to an agglomerated zeolitic adsorbent based on MSX zeolite crystals, having an Si/Al atomic ratio such that 1.10 ≤ Si/Al ≤ 1.18, preferably 1.10 ≤ Si/Al ≤ 1.17, more preferably 1.10 ≤ Si/Al ≤ 1.16, more preferably 1.11 ≤ Si/Al ≤ 1.16, of which at least 90%, preferably at least 95% of the exchangeable cationic sites are occupied, either by barium ions alone or by barium ions and potassium ions. More preferably, the disclosure relates to an agglomerated zeolitic adsorbent based on MSX zeolite crystals, having an Si/Al atomic ratio such that 1.11 ≤ Si/Al < 1.15, and more preferably 1.12 ≤ Si/ Al < 1.15, and advantageously 1.12 ≤ Si/Al ≤ 1.14, of which at least 90%, preferably at least 95% of the exchangeable cationic sites are occupied, either by barium ions alone or by barium ions and potassium ions. Even more preferably, the disclosure relates to an agglomerated zeolitic adsorbent based on MSX zeolite crystals, having an Si/Al atomic ratio such that 1.11 ≤ Si/Al < 1.15, and even more preferably 1.12 ≤ Si/Al < 1. 15, and advantageously 1.12 ≤ Si/Al ≤ 1.14, of which at least 90%, preferably at least 95%, of the exchangeable cationic sites are occupied, either by barium ions alone or by barium ions and potassium ions.

The micropore volume of the adsorbent, as measured according to the Dubinin method by nitrogen adsorption at 77K after pretreatment at 500°C for a period of 12 hours under vacuum, may be greater than or equal to 0.200 cm^3/g, preferably greater than or equal to 0.220 cm^3/g, even more preferably greater than or equal to 0.225 cm^3/g, in an even more preferable manner greater than or equal to 0.250 cm^3/g.

The exchangeable sites occupied by the potassium may represent up to 1/3 of the exchangeable sites occupied by the barium + potassium ions, with any possible balance being generally made up by alkali or alkaline-earth ions other than barium and potassium.

The adsorbent may comprise an inert binder in a proportion that is less than or equal to 20% by weight, preferably 15% by weight, of the total mass of the adsorbent.

The adsorbent may have a size distribution such that the number-average diameter is between 0.4 mm and 2.0 mm, preferably between 0.4 mm and 0.8 mm.

The mechanical strength of the adsorbent, as measured by the Shell method series SMS1471-74 that is appropriate for agglomerates having a size that is less than 1.6 mm, is advantageously greater than or equal to 2 MPa, preferably greater than or equal to 2.5 MPa.

The loss on ignition as measured at 900°C is advantageously less than or equal to 7.7%, preferably between 0 and 7.7%, in a preferable manner between 3.0% and 7.7%, in an even more preferable manner between 3.5% and 6.5%, and advantageously between 4.5% and 6.0%, inclusive of limits.

The MSX zeolite crystals may have a number average diameter of between 0.01 μm and 5 μm, preferably between 0.05 μm and 5 μm, in a highly preferable manner between 0.1 μm and 4 μm, in an even more preferable manner between 0.1 μm and 3 μm, and in an even more preferable manner between 0.1 μm and 2 μm.

The disclosure, in another aspect, also relates to a separation process for separating sugars, polyhydric alcohols, substituted toluene isomers, cresols, or for recovering *para*-xylene, by means of an agglomerated zeolitic adsorbent according to any of the variants described, in the presence of a desorbent, in liquid phase or in gas phase.

The process may be a *para*-xylene recovery process for recovering *para*-xylene from fractions of C_8 aromatic isomers, by adsorption of *para*-xylene by means of the said agglomerated zeolitic adsorbent, in the presence of a desorbent, in liquid phase or in gas phase.

The recovery process for recovering *para*-xylene may be implemented by means of a simulated moving bed process, of the simulated co-current or simulated counter-current type.

The process may be a production process for producing high purity, high productivity para-xylene from a feed mixture of aromatic hydrocarbons comprising 8 carbon atoms containing (C8) isomers, the process including the following steps:

a) a contacting step for bringing the feed mixture into contact with a bed of agglomerated zeolitic adsorbent, in a manner so as to preferentially adsorb the para-xylene;

b) a contacting step, under desorption conditions, for bringing the adsorbent bed into contact with a desorbent, which is preferably either toluene, or para-diethylbenzene;

c) a withdrawal step for withdrawing from the adsorbent bed a stream containing the desorbent and the least selectively adsorbed products of the feed mixture;

d) a withdrawal step for withdrawing from the adsorbent bed a stream containing the desorbent and the para-xylene;

e) a separation step for separating the stream obtained from the step c) into a first stream containing the desorbent and a second stream containing the least selectively adsorbed products of the feed mixture; and

f) a separation step for separating the stream obtained from the step d) into a first stream containing the desorbent and a second stream containing para-xylene having a purity level greater than or equal to 75%.

The said process may in addition include the following steps:

g) a crystallisation step in a crystalliser, consisting of the crystallisation of the para-xylene resulting from the step f), thereby making it possible to obtain, on the one hand, the para-xylene crystals soaked in the mother liquor thereof; and on the other hand, a mother liquor which may in part, or even in its entirety, be recycled as a mixture with the fresh feed mixture at the inlet of the simulated moving bed adsorption unit; and

h) a washing step for washing the crystals resulting from the step g), at the end of which para-xylene is recovered having a purity of at least 99.7%, and in a preferable manner of at least 99.8%.

More generally, the disclosure, in a further aspect, finally relates to the use of an agglomerated zeolitic adsorbent based on MSX zeolite crystals having an Si/Al atomic ratio such that $1.10 \leq Si/Al \leq 1.18$, preferably $1.10 \leq Si/Al \leq 1.17$, even more preferably $1.10 \leq Si/Al \leq 1.16$, even more preferably $1.11 \leq Si/Al \leq 1.16$, of which at least 90% of the exchangeable cationic sites are occupied, either by barium ions alone or by barium ions and potassium ions, for the separation of sugars, polyhydric alcohols, substituted toluene isomers, cresols, or for the recovery of para-xylene, in the presence of a desorbent, which is preferably either toluene or para-diethylbenzene, in liquid phase or in gas phase.

This use may relate to the recovery of *para*-xylene from fractions of C8 aromatic isomers, by adsorption of *para*-xylene in a simulated moving bed reactor, of the simulated co-current, or simulated counter-current type.