CATALYTIC COMPOSITION AND PROCESS USING IT FOR THE ALKYLATION OF AROMATIC HYDROCARBONS WITH ALCOHOLS, OR MIXTURES OF ALCOHOLS AND OLEFINS

Summary

In one aspect, there is provided a catalytic composition containing:

- a zeolite of the MTW type
- alkaline metals which are a mixture of sodium ions and potassium ions,

characterized in that:

the SiO_2/Al_2O_3 molar ratio in said zeolite is lower than or equal to 95,

wherein the total amount of alkaline metals in the catalytic composition is lower than or equal to 0.02% by weight.

In one aspect, there is provided a process for the alkylation of aromatic hydrocarbons with alcohols, or mixtures of the alcohol used and corresponding olefin, which comprises effecting said alkylation reaction in the presence of a catalyst as disclosed herein.

In one aspect, there is provided a catalytic composition containing:

- a zeolite of the MTW type
- alkaline metals which are a mixture of sodium ions and potassium ions,

characterized in that:

the minimum amount of sodium ions is 5 ppm,

the minimum amount of potassium ions is 5 ppm, and

the total amount of both ions is lower than or equal to 200 ppm by weight, with respect to the total weight of the catalytic composition, and

the SiO_2/Al_2O_3 molar ratio in said zeolite is lower than or equal to 95.

Description

The invention relates to a new catalytic composition

for the alkylation of aromatic hydrocarbons with alcohols or mixtures of alcohols and corresponding olefins, wherein said composition comprises a zeolite of the MTW type and is characterized in that it has a suitable and calibrated content of one or more alkaline metals.

The use of said composition in the alkylation of aromatic hydrocarbons with alcohols allows the formation, as by-product, of the aldehyde or ketone corresponding to the alcohol used, to be minimized: the formation of reaction by-products of said aldehydes or ketones is therefore significantly reduced, where said products have a boiling point very close to that of polyalkylation products, and are capable of causing poisoning of the catalyst in the subsequent transalkylation step for the recovery of said polyalkylates.

Catalysts based on phosphoric acid and diatomaceous earth for fixed-bed reactors or $ALCl_3$ in slurry, are still partially used in the petrochemical industry, in addition to zeolitic catalysts, in the alkylation reaction of aromatics with olefins. In all cases, the alkylation reaction of benzene with propylene is carried out under reaction conditions corresponding to the complete liquid phase of the reagent mixture. Problems relating to environmental impact and safety are however linked to processes based on the use of catalysts based on phosphoric acid and $AlCl_3$.

The preparation of cumene using zeolite X or zeolite Y as catalyst, was described for the first time in 1965 (Fnachev, Kr. M., et al, Nefiekhimiya 5 (1965)

CLAIMS

1. A catalytic composition containing:

- a zeolite of the MTW type

- alkaline metals which are a mixture of sodium ions and potassium ions,

characterized in that:

the minimum amount of sodium ions is 5 ppm,

the minimum amount of potassium ions is 5 ppm, and

the total amount of both ions is lower than or equal to 200 ppm by weight, with respect to the total weight of the catalytic composition, and

the SiO_2/Al_2O_3 molar ratio in said zeolite is lower than or equal to 95.

2. The composition according to claim 1, wherein the total weight of alkaline metal ions is lower than or equal to 0.015%

3. The composition according to one or more of the previous claims, containing a binder.

4. The composition according to claim 1, comprising a MTW zeolite in acid form wherein the cationic sites present in its structure are occupied by Na^+ and K^+ ions and the remaining cationic sites are occupied by H^+ ions.

5. The composition according to claim 4, wherein the zeolite is a ZSM-12 zeolite, having, in its calcined and anhydrous form, a molar composition of the oxides corresponding to the following formula:

$$1.0 \pm 0.4\ M_2O\ .\ Al_2O_3\ .\ 20\text{-}500\ SiO_2\ .\ zH_2O$$

wherein

z ranges from 0 to 60,

M is H^+ and Na^+ and K^+ ions, in a total amount lower than 0.02% by weight with respect to the total weight of the catalytic composition.

6. The composition according to claim 3, in the form of a pellet having a diameter ranging from 1.5 to 5 mm and a length ranging from 1 to 50 mm, with a hardness higher than or equal to 8 kg.

7. The composition according to claim 3, having an extrazeolitic porosity not lower than 0.4 ml/g, wherein said extrazeolitic porosity is for at least 30% characterized by pores having a diameter greater than 100 Å.

8. A process for the alkylation of aromatic hydrocarbons with alcohols, or mixtures of the alcohol used and corresponding olefin, which comprises effecting said alkylation reaction in the presence of a catalyst, according to one or more of the previous claims from 1 to 7.

9. The process according to claim 8, wherein the alcohol is an aliphatic alcohol containing from 1 to 8 carbon atoms.

10. The process according to claim 9, wherein the alcohol is ethanol or iso-propanol.

11. The process according to claim 8, wherein the alcohol is used in mixture with the corresponding olefin.

12. The process according to claim 8, carried out in gas phase, mixed phase or liquid phase.

13. The process according to claim 12, carried out under reaction conditions corresponding to a complete gas phase of the reagents.

14. The process according to claim 8, carried out under trickle-flow conditions.

15. The process according to claim 8, wherein the aromatic hydrocarbon is benzene, the alcohol is isopropanol, the alkylation product is cumene and said process comprises the following additional steps:

- oxidation of the cumene thus obtained to cumyl-hydroperoxide;
- treatment of the cumyl-hydroperoxide with acids to obtain a mixture of phenol and acetone;
- hydrogenation of the acetone to isopropanol which is recycled to the alkylation step.