

## Physical Chemistry : 2018 Transalkylation and disproportionation of 1,2,4 trimethylbenzene over faujasite zeolite- A.A.Elkahlawy- Cairo

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Huge pore faujasite zeolite (Pt/H-Y) and its dealuminated structure (Pt/H-DY) were applied for trans-alkylation of toluene and 1,2,4-trimethylbenzene (1,2,4-TMB). The acidic properties of supports were analyzed by utilizing NH<sub>3</sub>-TPD and FT-IR spectroscopy in the OH extending locale. XRD, SEM, DSC and FT-IR in the system district strategies were utilized to examine the auxiliary changes of zeolite after dealumination process. It was seen that the dealuminated impetus will in general have progressively open structure; such auxiliary changes are accepted to make up for the loss of some corrosive locales to achieve the upgraded movement and soundness over the parent zeolite. The zeolite structure impacts aromatics change. It was discovered that the utilization of 1,2,4-trimethylbenzene (TMB) as an alkylation specialist gave the best return of xylenes. A solid rivalry between transalkylation, disproportionation and isomerization of sweet-smelling hydrocarbons happens concurring impetus sharpness and response temperature. As it is notable, that xylenes (Xs) are significant beginning materials for the mechanical procedures like the creation of synthetic strands, plasticizers and saps. The significant sources of these sweet-smelling hydrocarbons, the transforming and pyrolysis fuels, have additionally an appreciable substance of toluene (T=C<sub>7</sub>) and trimethylbenzenes. (TMBs =C<sub>9</sub>). A advantageous approach to overhaul low esteem C<sub>7</sub> and C<sub>9</sub> aromatics comprises of their change to benzene (B) and xylene (X). In this specific situation, different processes such as: the disproportionations of toluene and trimethyl benzenes, the toluene alkylation with methanol, the toluene and alkylbenzenes hydrode-alkylation or the toluene and trimethyl benzenes transalkylation have been created [1-3]. The term transalkylation generally refers to the re-activity of polyalkylated aromatics by move of alkyl gatherings and development of lower alkylated aromatics. For example, by this method, some of the low esteemed by-product such as polyethyl and polyisopropyl benzenes are changed over to their mono-subbed homologues having greater levels of popularity [5]. The transalkylation of toluene with TMBs forming xylenes additionally a significant process in this field. Acid catalysts activate this last balance response. The business TMBs transalkylation forms use either silica or alumina or zeolite based impetuses, e.g., honorable metal supported on dealuminated mordenite [6]. Since of the huge atom fragrant hydrocarbons involved in the transalkylation response, only molecular sieves with huge pore, for example, beta, faujasite-Y and SAPO-5 [7] can catalyze this reaction. From the above writing overview, the pore size and the acidity of zeolites maybe the two elements of a decent impetus for transalkylation [8]. In the first place, only zeolites with 12-membered ring-opening have a pore size enormous enough for transalkylation of C<sub>9</sub>+ aromatics. Second, the higher acidity of the zeolites, the better is the action. In the present study, we researched the synergist exercises of Pt supported on H-Y

zeolite which has 12-MR pore openings, and of its dealuminated form. We additionally analyzed the physicochemical properties of the backings and the impetuses by different portrayal methods and the impacts of dealumination on the activity and stability of zeolite for transalkylation of toluene and 1,2,4-trimethylbenzene (1,2,4-TMB). In commercial processes such as BTX units, TMB isomers are the major components in C<sub>9</sub> aromatics and the part of 1,2,4-TMB among three isomers is about 65% [9]. For this reason, toluene and 1,2,4-TMB were utilized as the reactants. acidity of the zeolites, the better is the movement. In the present study, we researched the synergist exercises of Pt supported on H-Y zeolite which has 12-MR pore openings, and of its dealuminated form. We additionally inspected the physicochemical properties of the backings and the impetuses by different portrayal procedures and the impacts of dealumination on the activity and stability of zeolite for transalkylation of toluene and 1,2,4-trimethylbenzene (1,2,4-TMB). In commercial processes such as BTX units, TMB isomers are the major components in C<sub>9</sub> aromatics and the division of 1,2,4-TMB among three isomers is about 65% [9]. For this reason, toluene and 1,2,4-TMB were utilized as the reactants. Business NaY (SK-40) gave by Union Carbide Co., USA, was utilized for impetus planning. NH<sub>4</sub>-Y was set up by trade the sodium particle in Na-Y zeolite a few times with ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>) molar solution; each time with a new answer for 8h at 70 °C. The zeolite was then isolated, washed with bidistilled water till free of the NO<sub>3</sub><sup>-</sup>, and afterward dried at 110 °C overnight. NH<sub>4</sub>-Dealuminated sample (NH<sub>4</sub>-DY) was prepared by extraction of some aluminum oxide from NH<sub>4</sub>-Y by refluxing 20gms sample in 300cm<sup>3</sup> doubly distilled water with 9.6gmol of (NH<sub>4</sub>)<sub>2</sub>H<sub>2</sub>EDTA for 4h. The treated sample was then separated, washed and dried as mentioned above. Details on the dealumination procedure are given in earlier contemplations [10]. H-Y and H-DY samples were arranged by calcination of the NH<sub>4</sub>-Y and NH<sub>4</sub>-DY at 450 °C for 4h. This temperature was picked for pretreatment as at 450 °C warm dealumination doesn't occur in any case and a total deammoniation can be accomplished. The necessary amount of hexachloroplatinic corrosive (H<sub>2</sub>PtCl<sub>6</sub> .x H<sub>2</sub>O), necessary for loading 0.5wt% Pt, was broke down in bidistilled water sufficient to cover the support material in a beaker. A small quantity of citrus extract was added to upgrade infiltration of the forerunner molecules from the arrangement into the pores of the synergist support [11,12]. This planning was left overnight at room temperature then dried at 110 °C overnight. The impetus was calcined in air for 4h at 450 °C and reduced at 400 °C in H<sub>2</sub> stream of 20cm<sup>3</sup> min<sup>-1</sup> in a stream reactor for 2 h. Essential investigation was performed by X-ray fluorescence (XRF) technique. Surface territory and pore volumes of the backings were resolved by measuring the nitrogen adsorption-desorption isotherms at 77K (BET technique)

using Micromeritics Gemini 2375 surface zone analyzer, while porosity was controlled by poresizer 9320-V2-08. The estimations were performed on tests warmed at 200 °C for 2 h in an unadulterated nitrogen stream. Since the normal pore sizes of these examples are small, the mercury penetration method was lacking in the present study. Infrared (IR) spectra were recorded on an ATI Mattson Infinity series Apparatus, Model 960 M0009, for portrayal of supports and catalysts. The last spectra were taken after 64 sweeps with 2 cm<sup>-1</sup> resolution. Temperature-modified desorption of smelling salts (NH<sub>3</sub>-TPD) was utilized to describe the corrosive property of the utilized examples [14]. X-beam powder diffraction (XRD) patterns have been recorded on a Bruker AXS-D8 Advance (Germany) by utilizing nickel-separated copper radiation ( $\lambda = 1.5405 \text{ \AA}$ ) at 60 kV and 25 mA with a scanning velocity of 8° in 20 min<sup>-1</sup> over the diffraction point. The microstructure and morphology of the tests were examined by scanning electron microscopy (SEM) utilizing JXA-890 magnifying lens (Jed) at 30 kV. Differential scanning calorimetry (DSC) was utilized to decide the changes in the structure, i.e., progress, starting with one crystalline structure then onto the next, utilizing DSC-50 Shimadzu apparatus. Thermogravimetric analysis (TGA) was performed with a Perkin-Elmer contraption. All of the reactant hydroconversion runs were completed under a fixed-bed downflow framework. The stream framework comprised fundamentally of a vertical tubular silica-glass reactor (1.0 cm internal

diameter and 30.0 cm long). Containing 1.0 g of a new impetus, diluted with latent non-porous solid having a similar measurement of the impetus particles, was sandwiched between glass fleece connects put in the middle of the reactor. The reactor was warmed in a protected wider stainless steel tube coat thermostated to  $\pm 1^\circ\text{C}$ . The temperature of the impetus bed inside the reactor was estimated and controlled by means of a thermocouple and electronic controller. The lower part of the reactor connected to a twofold condenser connected to a flat flask to gather the fluid products for examination. Hydrogen gas was utilized as a transporter and simultaneously as a reactant in the response under study, at a flow rate of 20 cm<sup>3</sup> min<sup>-1</sup> in all runs. Hydrogen was supplied to the system from a chamber. The fluid feed was siphoned to the highest point of reactor by methods for dosing siphon. The impetus was diminished in H<sub>2</sub> at 400 °C for 2 h. Before beginning the re-activity runs the reaction was completed at environmental weight. Toluene and 1,2,4-TMB were disregarded the impetus at 7 h<sup>-1</sup> at the essential proportions and temperatures. The fluid products were gathered after a between val of 30 min for analysis using Perkin-Elmer Gas Chromatograph (Model Clarus 500) furnished with a capillary column 100 m  $\times$  0.25 ID for PONA analysis (initial temp. 80 °C and last temp. 300 °C). Indicator and injector temperature was 300 °C and transporter gas was He with flow rate of 30 ml/min.

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