

PADA MODIFIKASI ZEOLIT ALAM

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RINGKASAN

Zeolit alam merupakan material berpori yang telah dimanfaatkan dalam bidang industri sebagai adsorben, katalis, penyaring molekuler, penukar ion dan padatan pendukung. Ukuran pori zeolit alam mayoritas adalah kurang dari 20 ? sehingga kemampuan adsorpsi terhadap molekul berukuran besar menjadi tidak optimal. Salah satu upaya meningkatkan efektivitas kemampuan tersebut dapat dilakukan dengan memodifikasi ukuran pori zeolit alam. Penelitian ini bertujuan memperoleh material hasil modifikasi zeolit alam berupa padatan kristal berpori dengan ukuran pori yang lebih besar dari zeolit alam dan mengkaji pengaruh rasio Si/Al terhadap ukuran pori material hasil modifikasi.

Modifikasi dilakukan melalui beberapa tahap yaitu: destruksi, perlakuan hidrotermal dan kalsinasi. Proses destruksi dilakukan dengan penambahan NaOH ke dalam zeolit alam dan dipanaskan pada temperatur 500 (C. Hasil destruksi berupa filtrat akan digunakan sebagai bahan utama pembentukan material dalam modifikasi. Untuk meningkatkan kandungan Si dilakukan dengan menambahkan larutan garam Natrium Silikat ke dalam filtrat. Proses pembentukan ukuran pori dengan bantuan molekul pengarah dilakukan melalui proses hidrotermal di dalam autoklaf pada temperatur 120 (C selama 24 jam kemudian dilanjutkan proses kalsinasi pada temperatur 400 (C selama 7 jam. Karakterisasi material hasil modifikasi dilakukan dengan difraksi sinar-X dan metode adsorpsi gas N₂ (BET) untuk menentukan kristalinitas dan ukuran pori.

Hasil analisis Spektroskopi Serapan Atom (SSA) terhadap filtrat zeolit alam menunjukkan rasio Si/Al sebesar 13,91. Hasil analisis inframerah memperlihatkan bahwa molekul pengarah telah terdekomposisi dan menghasilkan material yang termasuk jenis zeolit ditandai dengan munculnya spektrum khas zeolit. Berdasarkan hasil analisis difraksi sinar-X, modifikasi zeolit alam dalam penelitian ini menghasilkan padatan berbentuk kristal dan hasil analisis ukuran pori menunjukkan adanya peningkatan ukuran pori menjadi lebih besar dari ukuran pori zeolit alam (16,19 ?). Ukuran pori terbesar dicapai pada ZSA-2 (rasio Si/Al = 24,57) sebesar 27,06 ?. Peningkatan ukuran pori juga diikuti peningkatan luas permukaan dan volume pori secara berturut-turut adalah 43,74 m²/g dan 59,18 x 10⁻³ cc/g.

SUMMARY

Natural zeolite is a porous material that has been used in industrial as adsorbent, catalyst, molecular sieve, ion exchanger and supporting material. The majority of natural zeolite pore size is less than 20 \AA so that the ability to adsorb huge molecules is not optimum. One way to improve the effectiveness of zeolite ability to adsorb big molecules is by modify the pore size. The aim of this research are to obtain material result of natural zeolite modification in the form of solid porous crystal which the pore size is bigger than natural zeolites and to study the influence of Si/Al ratio to material pore size resulted from modification.

Modification through some phases that were: destruction, hydrothermal and calcination. Destruction was done using NaOH that was added into natural zeolite and heated at 500 (C. Filtrate from the destruction process than used as raw material for new material. To increase the content of Si was done by addition of Sodium Silicate into the filtrate. The pore size forming process was conduct by directing agent through process of hydrothermal in autoclave at temperature of 120 (C during 24 hours then continued by calcination at temperature of 400 (C during 7 hours. Material that resulted from modification than characterized with N_2 gas sorption method (BET) and X-ray diffraction method to determine pore size and cristallinity respectively.

Result of Atomic Absorption Spectroscopy analysis (AAS) to natural zeolite filtrate showed Si/Al ratio of 13,91. Result of infrared analysis indicated that directional molecule was decomposed and yielded material which including zeolite type marked with typical spectrum appearance of zeolite. Based on X-ray diffraction analysis, natural zeolite modification in this research yielded solid crystal and the result of pore analysis showed the improvement of pore size that bigger than natural zeolite (16,19 \AA). The biggest pore size of 27,06 \AA obtained at ZSA-2 (Si/Al ratio 24,57). The improvement of pore size also related to the improvement of pore volume and surface area that are 43,74 m^2/g and 59,18 $\times 10^{-3} \text{ cc/g}$ respectively.

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