Modifikasi zeolit alam dari bayat klaten dengan metode tandem acid base treatments untuk alternatif pengolahan limbah thorium di instalasi pengolahan limbah radioaktif batan = Modification of natural zeolite from bayat klaten using tandem acid base treatments as altenative way in thorium radioactive waste treatment

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Abstrak

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Telah dilakukan modifikasi zeolit alam dari Bayat-Klaten untuk material alternatif pengolahan limbah Thorium di Instalasi Pengolahan Limbah Radioaktif Batan. Zeolit alam yang umumnya merupakan material dengan ukuran mikropori dimodifikasi dengan menggabungkan dua metode yang biasa dilakukan untuk mengubah ukuran mikropori zeolit menjadi zeolit hierarki, yaitu dealuminasi dan desilikasi. Proses dealuminasi diharapkan dapat meningkatkan rasio Si:Al sehingga terjadi proses pengaturan ulang dalam kerangka zeolit, kemudian dilakukan proses desilikasi yang bertujuan untuk melarutkan sebagian Si dalam kerangka zeolit dan mengarahkan pembentukan mesopori dalam zeolit sehingga dapat meningkatkan kapasitas adsorpsi zeolit alam Bayat. Karakterisasi dilakukan dengan menggunakan XRD, FTIR, BET, SEM-EDS, dan AAS. Pola difraksi XRD untuk raw zeolite, zeolit pre-treatment, NaZ, ZA1, ZA2, ZA2B, ZB1 menunjukkan bahwa proses modifikasi ini tidak mengubah struktur kristal zeolit. Dalam penelitian ini setelah proses dealuminasi terjadi peningkatan rasio Si/Al dari sebelumnya 6,688 untuk NaZ menjadi 11,401 untuk zeolit alam termodifikasi dengan metode tandem acid-base treatments (ZA2B). Luas permukaan zeolit juga mengalami peningkatan, dari sebelumnya 125,4m2/g (NaZ) menjadi 216,8m2/g (ZA2B). Zeolit yang berhasil dimodifikasi memiliki sisi aktif yang cukup besar yang dapat berperan menjadi adsorben limbah Th4+ yang lebih baik daripada zeolit tanpa modifikasi. Terlihat dari data UV-Visibel larutan Th4+ yang teradsorpsi dalam zeolit alam termodifikasi adalah ca. 4,2 mg/g pada waktu 120 menit sementara pada waktu yang sama zeolit tanpa modifikasi hanya mengadsorpsi Th4+ sebesar ca. 3,92 mg/g. Adsorpsi Th(IV) oleh zeolit alam dari Bayat ini mengikuti isotherm adsorpsi Freundlich dengan kapasitas adsorpsi untuk NaZ dan ZA2B sebesar 909 mg/g dan 2000 mg/g. Hasil imobilisasi zeolit alam yang mengandung Th(IV) dengan menggunakan resin epoksi yang optimum didapat pada blok polimer-limbah dengan waste loading 30%.
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ABSTRACT
Hierarchical zeolite was prepared from natural zeolite using tandem acid-base treatments and applied as adsorbent in removal Th(IV) waste in the Installation of

Radioactive Waste Management. Natural zeolite occurred naturally to have micropore size, was modified with two familiar methods that mostly used to change its micropore size into hierarchical pores in which are dealumination and desilication. Extensive characterization of both natural and modified zeolite were conducted using XRD, BET, SEM-EDS, AAS. XRD Pattern of Raw Zeolite, Pretreated Zeolite, NaZ, ZA1, ZA2, and ZA2B shows that the process to modify this material has not changed the crystallinity characteristic of this material. The Si/Al ratio is increased from 6.688 to 11.401 for NaZ and ZA2B respectively. Surface area is increased from 125.4 m2/g (NaZ) to216.8 m2/g (ZA2B). Application of these material as adsorbent were carried out using solution of 50 ppm Th4+. The UV-Vis result shows the modified zeolite (c.a. 10 mg) has higher adsorption capacity than the natural zeolite. The adsorption process is fit into Freundlich isotherm and the adsorption capacity of this material increase from 909 mg/g to 2000 mg/g for NaZ and ZA2B respectively.;Hierarchical zeolite was prepared from natural zeolite using tandem acid-base
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