

ABSTRAK

SINTESIS DAN KARAKTERISASI MATERIAL BCNO DENGAN DOPAN LOGAM Mg DAN Na UNTUK APLIKASI ADSORPSI PADA AIR SUNGAI CIKAPUNDUNG

Pencemaran air sungai terutama oleh limbah domestik dan industri menjadi masalah serius di berbagai wilayah, termasuk di Sungai Cikapundung, Bandung. Penelitian ini bertujuan untuk mensintesis dan mengkarakterisasi material boron carbonitride oxide (BCNO) yang didoping dengan logam magnesium (Mg) dan natrium (Na) sebagai material adsorben potensial untuk pemurnian air. Sintesis BCNO dilakukan dengan metode solid state yang berbasis green chemistry dengan suhu kalsinasi sebesar 550°C selama 30 menit. Hasil sintesis kemudian dikarakterisasi lalu dilakukan pengujian terhadap aktivitas adsorpsi dengan waktu 120 menit. Berdasarkan hasil XRD menunjukkan bahwa doping Na meningkatkan kristalinitas sedangkan doping Mg menghasilkan struktur amorf. Hasil SEM menunjukkan bentuk aglomerasi serta ukuran partikel tidak seragam pada BCNO dan Na-BCNO, namun pada Mg-BCNO justru menunjukkan perubahan drastis struktur permukaannya yang cenderung lebih seragam dan distribusi ukuran partikelnya lebih merata. Meskipun morfologi permukaan cenderung mengalami aglomerasi, doping juga memperkaya gugus fungsional aktif yang mendukung kinerja adsorpsi. Uji adsorpsi dilakukan terhadap air sungai yang tercemar dengan parameter fisika, kimia, logam berat, dan mikrobiologi. Hasil menunjukkan bahwa Na-BCNO memiliki performa adsorpsi terbaik, diikuti oleh Mg-BCNO dan Na BCNO. Na BCNO-menurunkan kadar TSS (97,45%), BOD (98%), COD (50,2%), amonia dan logam berat hingga di bawah batas deteksi, Mg-BCNO efektif terhadap parameter mikrobiologis seperti fecal coliform dan total coliform.

Kata kunci : sintesis, adsorpsi, Mg-BCNO, Na-BCNO, solid state

ABSTRACT

SYNTHESIS AND CHARACTERIZATION OF BCNO MATERIAL WITH Mg AND Na METAL DOPANTS FOR ADSORPTION APPLICATION IN CIKAPUNDUNG RIVER WATER

River water pollution, especially by domestic and industrial waste, has become a serious problem in various regions, including the Cikapundung River in Bandung. This research aims to synthesize and characterize boron carbonitride oxide (BCNO) material doped with magnesium (Mg) and sodium (Na) as potential adsorbent materials for water purification. The synthesis of BCNO was carried out using a solid-state method based on green chemistry with a calcination temperature of 550°C for 30 minutes. The synthesis results were then characterized and tested for adsorption activity over a period of 120 minutes. Based on the XRD results, it shows that Na doping increases crystallinity while Mg doping results in an amorphous structure. The SEM results show that there is an agglomeration shape and non-uniform particle size in BCNO and Na-BCNO, while Mg-BCNO shows a drastic change in its surface structure that tends to be more uniform and has a more even particle size distribution. Although the surface morphology tends to experience agglomeration, doping also enriches the active functional groups that support adsorption performance. Adsorption tests were conducted on polluted river water with physical, chemical, heavy metal, and microbiological parameters. The results show that Na-BCNO has the best adsorption performance, followed by Mg-BCNO and BCNO. Na-BCNO reduced TSS levels (97.45%), BOD (98%), COD (50.2%), ammonia, and heavy metals to below detection limits, while Mg-BCNO was effective against microbiological parameters such as fecal coliform and total coliform.

Keywords: synthesis, adsorption, Mg-BCNO, Na-BCNO, solid state