

PREPARASI NANOPARTIKEL $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ -KITOSAN UNTUK ADSORPSI ION TEMBAGA DI DALAM AIR

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INTISARI

Dalam penelitian ini telah dikaji pembuatan Fe_3O_4 , $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ core-shell, dan $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ -kitosan sebagai nanopartikel adsorben magnetik untuk adsorpsi ion Cu(II) . *Magnetic Nanoparticles* (MNPs) diperoleh dengan pengendapan silika ke dalam nanopartikel magnetik melalui penambahan TEOS (*tetra ethyl ortho silicate*). Lapisan nanopartikel Fe_3O_4 dengan SiO_2 mencegah aglomerasi partikel dengan membentuk inti $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ dan menghindari peleburan inti Fe_3O_4 dalam media asam.

Morfologi nanopartikel silika magnetik telah diselidiki menggunakan FTIR, XRD, SEM-EDX, dan TEM. Data FTIR, XRD dan EDX menunjukkan bahwa bahan-bahan tersebut berhasil menempel pada permukaan nanopartikel. TEM dan SEM-EDX mengungkapkan bahwa Fe_3O_4 , $\text{Fe}_3\text{O}_4@ \text{SiO}_2$, dan $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ -kitosan berbentuk bulat.

Diameter nanopartikel yang terbentuk sebesar 80,96 nm dan magnetit yang dilapisi silika memiliki struktur inti ditandai dengan munculnya bilangan gelombang 1444 cm^{-1} yang menunjukkan ikatan Si-O-Si. MNPs yang dimodifikasi ini juga ditambahkan kitosan sebagai adsorben selektif dan didapatkan adsorpsi maksimum sebesar $79,83 \text{ mg g}^{-1}$ pada pH 3 dengan massa adsorben sebesar 10 mg dengan waktu kontak 900 menit dan konsentrasi awal larutan sebesar 40 mg L^{-1} .

Kata Kunci: MNPs, Kitosan, ion Cu(II) , adsorben magnetik.

PREPARATION OF $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ -CHITOSAN NANOPARTICLES FOR ADSORPTION COPPER IONS IN WATER

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ABSTRACT

In this research, Fe_3O_4 , $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ core-shell and $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ -chitosan were studied as magnetic adsorbent nanoparticles for adsorption of Cu(II) ions. Magnetic nanoparticles (MNPs) were obtained by precipitation of silica into magnetite nanoparticles through addition of TEOS (tetra ethyl ortho silane). Fe_3O_4 nanoparticles with SiO_2 layers prevent particle agglomeration by forming $\text{Fe}_3\text{O}_4 @ \text{SiO}_2$ nuclei and avoiding the fusion of Fe_3O_4 nuclei in acidic media.

The morphology of magnetic silica nanoparticles was investigated with FTIR, XRD, SEM-EDX, and TEM. Data of FTIR, XRD, and EDX show that these materials are successfully attached to the surface of the nanoparticles. TEM and SEM-EDX images reveal that Fe_3O_4 , $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ core-shell and $\text{Fe}_3\text{O}_4@ \text{SiO}_2$ -chitosan are all spherical.

The diameter of the nanoparticles formed was 81,01 nm and the magnetite coated with silica had a core structure characterized by the appearance of IR peak 1444 cm^{-1} , which is due to Si-O-Si bond. The MNPs were also modified further with chitosan as a selective adsorbent and obtained maximum adsorption of $79,83 \text{ mg g}^{-1}$ at pH 3 with a mass of 10 mg adsorbent with a contact time of 900 minutes and the initial concentration of the solution of 40 mg L^{-1} .

Keywords: MNPs, chitosan, Cu(II) ion, magnetic adsorbent