

ADSORPSI-DESORPSI Au(III), Cu(II) dan Ni(II) DARI LARUTAN HASIL DESTRUKSI *PRINTED CIRCUIT BOARD* (PCB) DENGAN KITOSAN/SILIKA TERLAPIS PADA BAHAN MAGNETIK PASIR BESI

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INTISARI

Adsorpsi-desorpsi Au(III), Cu(II) dan Ni(II) dari larutan hasil destruksi *Printed Circuit Board* (PCB) menggunakan kitosan/silika terlapis pada bahan magnetik pasir besi (BMSiK) telah dilakukan. Penelitian ini diawali dengan preparasi sampel PCB dan dipotong berukuran 0,25-1 cm². Potongan PCB dilarutkan dalam akuaregia, dan kandungan ion Au(III), Cu(II) dan Ni(II) ditentukan dengan *Atomic Absorption Spectroscopy* (AAS). Selektivitas dan efektivitas adsorben BMSiK diuji melalui adsorpsi Au(III) pada pH 3 dalam larutan multi-logam Au/Cu/Ni yang konsentrasinya mirip dengan larutan sampel dan desorpsi dilakukan menggunakan larutan 6% tiourea dalam 0,1M HCl. Adsorben setelah adsorpsi-desorpsi dipisahkan dari larutan menggunakan batang magnet. Adsorpsi-desorpsi dilakukan sebanyak lima kali pengulangan dan kemudian adsorben diaplikasikan untuk *recovery* Au(III) dalam larutan PCB. Pekerjaan yang sama juga dilakukan untuk mempelajari faktor prekonsentrasi dengan variasi volume (100, 250 dan 500 mL). Konsentrasi ion logam yang tidak teradsorpsi dan yang terdesorpsi ditentukan menggunakan AAS. Adsorben sebelum dan setelah adsorpsi-desorpsi dikarakterisasi dengan *Fourier Transform Infrared* (FTIR) *Spectrophotometer*, *X-Ray Diffractometer* (XRD), *Scanning Electron Microscopy* (SEM) dan *Transmission Electron Microscopy* (TEM). Hasil menunjukkan bahwa PCB mengandung Au, Cu dan Ni masing-masing 2,93±0,01; 861,62±7,74 dan 69,22±5,02 mg/g. BMSiK dapat digunakan kembali dua kali untuk adsorpsi-desorpsi dengan *recovery* Au(III) 87,66±1,62% dan turun menjadi 43,76±4,42% pada penggunaan ulang ke tiga. Prekonsentrasi Au(III) dengan BMSiK mencapai faktor prekonsentrasi 25 kali dengan *recovery* 82,22±0,71%. Aplikasi BMSiK berhasil dilakukan untuk adsorpsi-desorpsi ion Au(III) pada larutan sampel PCB dengan *recovery* 76,12±0,83%, sedangkan ion Cu(II) dan Ni(II) masing-masing hanya mencapai 0,78±0,02 dan 0,41±0,03% dengan faktor selektivitas $\alpha_{Au/Cu}$ dan $\alpha_{Au/Ni}$ masing-masing 22,68±1,36 dan 7,04±0,84.

Kata kunci: adsorpsi, emas, kitosan, silika, bahan magnetik

ADSORPTION-DESORPTION OF Au(III), Cu(II) and Ni(II) FROM SOLUTION OF THE DESTRUCTED PRINTED CIRCUIT BOARD WITH CHITOSAN/SILICA COATED ON IRON SAND MAGNETIC MATERIAL

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ABSTRACT

Adsorption-desorption of Au(III), Cu(II) and Ni(II) from solution of the destructed Printed Circuit Board (PCB) using adsorbent of chitosan/silica coated on iron sand magnetic material (MMSiC) has been studied. This research was started with preparation of PCB sample and cut into the size of 0.25-1 cm². PCB pieces then were dissolved in aquaregia solution and the content of Au(III), Cu(II) and Ni(II) ions were determined with Atomic Absorption Spectroscopy (AAS). Selectivity and effectiveness of MMSiC adsorbent were examined by adsorption of Au(III) ion at pH 3 in Au/Cu/Ni multi-metal solution with the concentration similar to that in the sample solution. Desorption was conducted with thiourea solution 6% in HCl 0.1M. Adsorbent after adsorption-desorption was separated with an external magnetic bar. Adsorption-desorption was carried out five repetitions and then the adsorbent was applied for recovery of Au(III) in PCB solution. The analogue work was performed to determine the pre-concentration factor by varying the volume (100, 250 and 500 mL). Metal ions not adsorbed and desorbed were analysed using AAS. Adsorbent before and after adsorption-desorption were characterized using Fourier Transform Infrared (FTIR) Spectrophotometer, X-Ray Diffractometer (XRD), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). The result showed that PCB contained Au, Cu and Ni of 2.93±0.01, 861.62±7.74 and 69.22±5.02 mg/g, respectively. MMSiC was reusable two times for adsorption-desorption with recovery of Au(III) of 87,66±1,62% and decreased significantly into 43,76±4,42% at the 3rd repetition. Pre-concentration of Au(III) with MMSiC reached pre-concentration factor of 25x with the recovery of 82,22±0,71%. MMSiC was successfully applied for adsorption-desorption of Au(III) ion in PCB sample with the recovery of 76.12±0.83%, while Cu(II) and Ni(II) of only 0.78±0.02 and 0.41±0.03%, and the selectivity factors of $\alpha_{Au/Cu}$ and $\alpha_{Au/Ni}$ were 22.68±1.36 and 7.04±0.84, respectively.

Keywords: adsorption, gold, chitosan, silica, magnetic material.