

PENGEMBANGAN *BEADS* PVA-NATRIUM ALGINAT SEBAGAI MATRIKS IMOBILISASI 1,5-DIFENILKARBAZIDA UNTUK DETEKSI Cr(VI)

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INTISARI

Telah dilakukan sintesis *beads* PVA–natrium alginat sebagai matriks imobilisasi 1,5–difenilkarbazida (DPC) untuk deteksi Cr(VI). Penelitian ini bertujuan untuk mengembangkan sensor Cr(VI) berbasis matriks padat *beads*, mempelajari kondisi optimum *sensing*, menentukan interferensi ion dan mengaplikasikan *beads* sensor untuk deteksi Cr(VI) dalam sampel air limbah. Keberadaan Cr(VI) dalam sampel di atas batas deteksi *beads* sensor ditandai dengan perubahan warna *beads* dari merah muda pucat menjadi ungu sebagai hasil reaksi antara Cr(VI) dengan DPC.

Beads PVA–natrium alginat–DPC dibuat dengan metode PVA–asam borat. Konsentrasi total PVA, natrium alginat dan DPC yang digunakan adalah 10% (b/b), 1% (b/b), dan 4,53 mg DPC g⁻¹ *beads*. *Beads* yang dihasilkan dikarakterisasi dengan menggunakan spektrometer FTIR. Hasil karakterisasi menunjukkan adanya interaksi antara PVA, natrium alginat, DPC, dan senyawa kompleks Cr(VI)–DPC.

Pengukuran absorbansi *beads* dilakukan pada panjang gelombang 546,67 nm. Respon optimum *beads* sensor diperoleh setelah proses *sensing* selama 8 menit pada pH 2. Linieritas kurva kalibrasi diperoleh pada rentang konsentrasi 2–8 mg L⁻¹, dengan nilai R² sebesar 0,999, batas deteksi dan batas kuantifikasi untuk 25 mL sampel adalah sebesar 0,11 dan 0,34 mg L⁻¹. *Beads* sensor memiliki presisi dan akurasi yang cukup baik dengan nilai RSD < 5% dan nilai persen perolehan kembali antara 84–119%. *Beads* sensor memiliki stabilitas yang cukup baik selama masa penyimpanan 30 hari. Keberadaan Hg(II) dengan konsentrasi ≥20 mg L⁻¹ dapat meningkatkan absorbansi hingga 5,44% tetapi tidak mengganggu proses deteksi secara visual. *Beads* sensor mampu mendeteksi Cr(VI) dalam sampel air limbah. Hasil pengukuran konsentrasi Cr(VI) dalam air limbah dengan *beads* sensor memiliki nilai ketepatan 80–96% relatif terhadap metode standar DPC secara spektrofotometri.

Kata kunci: *beads* PVA–natrium alginat, *beads* sensor, deteksi Cr(VI), DPC

DEVELOPMENT OF PVA-SODIUM ALGINATE BEADS AS IMMOBILIZATION MATRICES OF 1,5-DIPHENYLCARBAZIDE FOR THE DETECTION OF Cr(VI)

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ABSTRACT

PVA–sodium alginate beads have been synthesized as a matrix for the immobilization of 1,5–diphenylcarbazide (DPC) as a sensor for the detection of Cr(VI). The aims of this research were to develop Cr(VI) sensor based on solid matrix beads, to study the optimum condition of sensing, to determine the interference of any ions and applying beads sensors for the detection of Cr(VI) in waste water samples. In the presence of Cr(VI), the color of beads sensor changed from pale pink into purple as a result of reaction between Cr(VI) with DPC.

Beads were prepared by using PVA–boric acid method. The total concentration of PVA, sodium alginate and DPC is 10% (w/w), 1% (w/w), and 4.53 mg DPC g⁻¹ beads. The resulted beads were characterized by using FTIR spectrometer. The interaction between PVA, sodium alginate, DPC and Cr(VI)–DPC complex proved by the FTIR spectra.

The absorbance measurement was carried out at a wavelength of 546.67 nm. The optimum response of the beads sensor was obtained at pH 2, for 8 minutes sensing. The linearity of the calibration curve was obtained in the concentration range of 2–8 mg L⁻¹, with a coefficient correlation of 0.999, limit of detection and limit of quantification for 25 mL sample are 0.11 and 0.34 mg L⁻¹, respectively. The beads sensor has a good precision and accuracy with the relative standard deviation was less than 5% and the % recovery value between 84-119%. The beads sensor exhibited good stability for 30 days. The existence of Hg (II) with the concentration ≥ 20 mg L⁻¹ could increase the absorbance up to 5.44%, but does not interfere the visual detection process. The beads sensor were applied for determination of Cr(VI) in waste water samples and was able to detect the presence of Cr(VI). The satisfactory results were obtained by measuring the absorbance of beads after sensing in a waste water sample with the accuracy value between 80-96% relative to the reference method.

Keywords: PVA–sodium alginate beads, beads sensors, Cr(VI) detection, DPC