PENGEMBANGAN *FLUORESCENT PROBE* KARBON DOT TERDOPING NITROGEN DAN SULFUR (N,S-CDs) DENGAN METODE FLUORESENSI SEBAGAI UPAYA DETEKSI DINI Cr(VI) DI LINGKUNGAN PERAIRAN

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INTISARI

Pengembangan *fluorescent probe* dilakukan dengan mensintesis karon dot terdoping N dan S (N,S-CDs) menggunakan bantuan teknik *microwave*. N,S-CDs berfungsi sebagai *biosensor* untuk deteksi dini Cr(VI) di lingkungan perairan. Pada penelitian ini dipelajari optimasi waktu iradiasi yang dilakukan pada 5, 10, 20, 30, 40, 50, dan 60 menit. Pengaruh massa ammonium persulfat sebagai sumber dopan N dan S terhadap asam sitrat juga ditinjau pada variasi massa 10, 25, 50, 75, dan 100% (b/b asam sitrat). Waktu iradiasi dan massa ammonium persulfat yang optimal digunakan untuk sintesis N,S-CDs dan selanjutnya dilakukan pengkajian terhadap stabilitas N,S-CDs, sensitivitas, selektivitas dan anti-interferensinya terhadap ion logam lain. Pada tahap ini, semua kondisi optimal N,S-CDs digunakan untuk deteksi Cr(VI) di lingkungan perairan.

Berdasarkan spektra FTIR, ditunjukkan bahwa atom N dan S telah berhasil terpasivasi di permukaan CDs dengan keberadaan vibrasi karakteristik ikatan N-H dan C-N untuk doping atom N serta S-H dan -SO_3 untuk doping atom S. Karakterisasi dengan TEM menunjukkan bahwa N,S-CDs memiliki rata-rata ukuran 5 nm dengan beberapa bagian yang beraglomerasi. Spektra fluoresensi menunjukkan bahwa intensitas tertinggi diperoleh pada waktu iradiasi 50 menit dengan massa ammonium persulfat 50% dan kondisi asam (pH 5). Pada penelitian ini mekansime interaksi antara N,S-CDs dengan Cr(VI) dapat dikaitkan dengan proses *quenching* fluoresensi terutama *Inner Filter Effect* (IFE) dan dengan membandingkan respon fluoresensinya maka diperoleh batas deteksi (LOD) sebesar 0,0382 ppm dan batas kuantitasi (LOQ) sebesar 0,1272 ppm.

Kata kunci: ammonium persulfat, asam sitrat, Cr(VI), fluoresensi, N,S-CDs.

DEVELOPMENT OF FLUORESCENT PROBE NITROGEN, SULFUR CO-DOPED CARBON DOTS (N,S-CDs) USING FLUORESCENCE METHOD FOR EARLY DETECTION OF Cr(VI) IN THE WATER ENVIRONMENT

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ABSTRACT

The development of a fluorescent probe has been conducted by synthesizing N,S co-doped carbon dots (N,S-CDs) through microwave-assisted technique. N,S-CDs have a function as a biosensor for early detection of Cr(VI) in the water environment. In this present study, optimization of irradiation time was investigated at 5, 10, 20, 30, 40, 50, and 60 min. The effect of dopant N and S was examined by varying ammonium persulfate masses of 10, 25, 50, 75, and 100% (wt./wt. citric acid). The optimal irradiation time and mass of ammonium persulfate were then employed to synthesis of N,S-CDs, and further assessment of its stability, sensitivity, selectivity and anti-interference to other metal ions was evaluated. In this stage, all optimal conditions of N,S-CDs were eventually applied to detect Cr(VI) in the water environment.

Based on the FTIR spectra, it was confirmed that N and S atoms have been successfully passivated on the CDs surface as pointed by the presence of characteristic vibrations of N-H and C-N bonds for N atom doping as well as S-H and $-SO_3$ for S atom doping. Characterization by TEM exhibited that N,S-CDs had an average size of 5 nm with some agglomerated parts. Fluorescence spectra showed that the highest intensity was obtained at irradiation time of 50 minutes with ammonium persulfate mass of 50% and acidic conditions (pH 5). In this study, the interaction mechanism between N,S-CDs and Cr(VI) can be associated with the fluorescence quenching process especially the Inner Filter Effect (IFE), and by comparing the fluorescence response the limit of detection (LOD) and limit of quantitation (LOQ) were 0.0382 ppm and 0.1272 ppm, respectively.

Keywords: ammonium persulfate, citric acid, Cr(VI), fluorescence, N,S-CDs.