MICROWAVE-ASSISTED SYNTHESIS OF AMIKACIN MODIFIED N,S CO-DOPED CARBON DOTS FOR *Escherichia coli* DETECTION

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ABSTRACT

Synthesis of amikacin modified N,S co-doped carbon dots (N,S-CDs) through microwave-assisted process in solid phase has been conducted and evaluated for its ability to detect *Escherichia coli* (*E. coli*). In this present study, the influence of thiourea concentrations as the source of N and S dopants was also investigated. Prior to preparation of amikacin modified N,S-CDs, optimization of irradiation time was conducted for 5, 10, 20, 30, 40, and 50 min. The effect of dopant was examined by varying thiourea contents of 0, 10, 25, 50, 75, and 100% (wt./wt. citric acid). The optimized irradiation time and thiourea concentration were then employed to synthesis amikacin modified N,S-CDs. In this stage, masses of amikacin were also varied at 12.5, 25, 50, and 75 mg and eventually applied to *E. coli* detection.

Based on FTIR spectra, it was validated that N and S atoms were successfully doped as pointed by characteristic vibrations of C=N and C–N heterocycles as well as C–S bonds. Amikacin modified N,S-CDs were identified to be formed by examining wavenumber shift of C=O stretching mode. XRD characterization and TEM image exhibited that the entire synthesized materials were amorphous with average size of 7 nm. Fluorescence spectra showed that the highest intensity was obtained at thiourea content of 75% and amikacin mass of 25 mg. By comparing the fluorescence responses of all investigated amikacin modified N,S-CDs towards *E. coli*, the lowest limit of detection (LOD) was attained by 25 mg amikacin modified N,S-CDs which was 1.526 cfu mL^{-1}.

Keywords: Amikacin modified N,S-CDs, citric acid, thiourea, *Escherichia coli*, fluorescence

SINTESIS KARBON DOT TERDOPING N DAN S TERMODIFIKASI AMIKACIN MENGGUNAKAN GELOMBANG MIKRO UNTUK DETEKSI *Escherichia coli*

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ABSTRAK

Sintesis karbon dot terdoping N dan S (N,S-CDs) termodifikasi amikacin menggunakan gelombang mikro dalam fasa padat telah dilakukan dan dikaji kemampuannya untuk deteksi Escherichia coli (*E. coli*). Pada penelitian ini, dipelajari pula pengaruh konsentrasi tiourea sebagai sumber dopan N dan S. Sebelum tahap sintesis N,S-CDs termodifikasi amikacin, optimasi waktu iradiasi dilakukan pada 5, 10, 20, 30, 40, dan 50 menit. Pengaruh dopan ditinjau melalui variasi konsentrasi tiourea yaitu 0, 10, 25, 50, 75, dan 100% (b/b asam sitrat). Waktu iradiasi dan konsentrasi tiourea yang telah teroptimasi selanjutnya digunakan untuk sintesis N,S-CDs termodifikasi amikacin. Pada tahap ini, massa amikacin dibedakan pada 12,5; 25; 50; dan 75 mg dan kemudian digunakan untuk deteksi bakteri *E. coli*.

Berdasar spektra FTIR, tervalidasi bahwa atom N dan S berhasil terdoping dengan keberadaan vibrasi karakteristik ikatan C=N dan C−N heterosiklik serta C−S. Pembentukan N,S-CDs termodifikasi amikacin dicirikan dengan pergerseran vibrasi ulur C=O. Karakterisasi dengan XRD dan citra TEM menunjukkan bahwa material yang disintesis bersifat amorf dan memilikirata-rata ukuran sebesar 7 nm. Spektra fluoresensi menunjukkan bahwa intensitas tertinggi diperoleh pada kadar tiourea sebesar 75% dan massa amikacin sejumlah 25 mg. Dengan membandingkan respon fluoresensi dari semua variasi N,S-CDs termodifikasi amikacin terhadap *E. coli*, limit deteksi (LOD) terendah diperoleh dengan menggunakan N,S-CDs termodifikasi 25 mg amikacin yaitu sebesar 1.526 cfu mL^{-1}.

Kata kunci: N,S-CDs termodifikasi amikacin, asam sitrat, tiourea, *Escherichia coli*, fluoresensi