

## ABSTRAK

### OPTIMASI *DISPERSIVE SOLID PHASE EXTRACTION* BERBASIS *GRAPHENE OXIDE* DARI CANGKANG KELAPA SAWIT MENGGUNAKAN *RESPONSE SURFACE METHODOLOGY* UNTUK PENENTUAN RESIDU ANTIBIOTIK *CIPROFLOXACIN*

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Penggunaan antibiotik terus meningkat salah satunya *Ciprofloxacin* (CIP) menimbulkan kekhawatiran mengenai pencemaran lingkungan perairan. *Graphene Oxide* (GO) yaitu material nano karbon dari cangkang kelapa sawit (CKS) dikembangkan sebagai adsorben alternatif dalam proses penyerapan antibiotik. Hal ini karena, kandungan karbon pada CKS tinggi sehingga dapat dimanfaatkan sebagai GO untuk proses adsorpsi residu antibiotik CIP. Penelitian ini bertujuan untuk mengembangkan adsorben GO dari limbah CKS dan mengoptimalkan penggunaannya pada teknik *Dispersive Solid Phase Extraction* (DSPE) untuk penghilangan CIP. Metode yang digunakan berupa Hummers termodifikasi untuk mensintesis GO dari CKS. Karakterisasi dilakukan menggunakan FTIR, SEM-EDX, UV-Vis dan XRD. Optimasi penyerapan CIP diidentifikasi melalui analisis RSM dengan *Box Behnken Design* (BBD) berdasarkan pH, dosis GO, dan waktu kontak. Hasil menunjukkan kondisi optimum pada pH 3,4; massa GO 37,90 mg; dan waktu kontak 58,84 menit dengan efisiensi adsorpsi berdasarkan hasil percobaan sebesar 84,28%. Nilai prediksi model sebesar 97,73% menunjukkan kesesuaian model baik. Mengindikasikan bahwa GO dari limbah CKS berpotensi sebagai adsorben alternatif yang efektif dan ramah lingkungan pada teknik DSPE dalam pengolahan limbah residu antibiotik CIP.

Kata kunci: antibiotik, *box behnken design*, *ciprofloxacin*, *graphene oxide* (GO), limbah cangkang kelapa sawit, *response surface methodology*

## **ABSTRACT**

### **OPTIMIZATION OF DISPERSIVE SOLID PHASE EXTRACTION BASED ON GRAPHENE OXIDE FROM PALM SHELL WASTE USING RESPONSE SURFACE METHODOLOGY FOR THE DETERMINATION OF CIPROFLOXACIN RESIDUES**

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The use of antibiotics continues to one of which is Ciprofloxacin (CIP) raises concerns about the pollution of the aquatic environment. Graphene Oxide (GO) which is a carbon nanomaterial from oil palm shells (CKS) was developed as an alternative adsorbent in the process of antibiotic absorption. absorption of antibiotics. This is because the carbon content in CKS is high so that it can be utilized as GO for the adsorption process of CIP antibiotic residues. This research aims to develop GO adsorbent from CKS waste and optimize its use in Dispersive Solid Phase Extraction (DSPE) technique for CIP removal. The method used was Hummers modified to synthesize GO from CKS. Characterization was performed using FTIR, SEM-EDX, UV-Vis and XRD. Optimization of CIP absorption was identified through RSM analysis with Box Behnken Design (BBD) based on pH, GO dosage, and contact time. Results showed optimum conditions at pH 3.4; GO mass of 37.90 mg; and contact time of 58.84 min with adsorption efficiency based on experimental results of 84.28%. experiment of 84.28%. The model prediction value of 97.73% indicates good model accuracy. Indicates that GO from CKS waste has the potential to be an effective and environmentally friendly alternative adsorbent in DSPE technology for the treatment of CIP antibiotic residue waste.

Key words: antibiotics, *box behnken design*, *ciprofloxacin*, *graphene oxide* (GO), *palm shell waste*, *response surface methodology*