BAB V
KESIMPULAN DAN SARAN

V.1 Kesimpulan

Dari hasil penelitian ini dapat diperoleh kesimpulan sebagai berikut:

1. Hasil karakterisasi sejumlah analisa XRD, SEM-EDX, dan FTIR menunjukkan terbentuknya MOF ZnBDC dan ZnBDC-ekstrak.
2. Kenaikan pH menyebabkan kapasitas adsorpsi MOF ZnBDC dan ZnBDC-ekstrak semakin tinggi. Kinerja adsorpsi yang paling tinggi ditunjukkan pada pH 10.
3. Semakin tinggi konsentrasi awal larutan MB, kapasitas adsorpsi MB pada MOF semakin tinggi. Penggunaan konsentrasi awal MB sebesar 1000 mg/L menunjukkan kemampuan adsorpsi MOF yang maksimal.
4. Penambahan ekstrak pada ZnBDC tidak mempengaruhi luas permukaan adsorben sehingga kenaikan kapasitas adsorpsi pada ZnBDC-ekstrak disebabkan karena interaksi kimia yang terjadi antara permukaan adsorben dengan molekul MB. Hasil studi kinetika adsorpsi yang mengikuti *model pseudo second order* memberikan konfirmasi bahwa proses adsorpsi berlangsung melalui mekanisme kimia (*chemisorption*).
5. Model isoterm adsorpsi mengikuti model Langmuir yang menunjukkan bahwa adsorpsi berlangsung secara *monolayer* pada permukaan homogen.
6. Parameter termodinamika menunjukkan bahwa proses adsorpsi bersifat spontan ($\Delta G^0 < 0$), endotermik ($\Delta H^0 > 0$), dan peningkatan entropi ($\Delta S^0 > 0$) yang menunjukkan peningkatan suhu dapat meningkatkan kapasitas adsorpsi.

V.2 Saran

Untuk pengembangan lebih lanjut, perlu dilakukan pengujian terhadap limbah tekstil aktual agar dapat mengevaluasi kinerja adsorben dalam kondisi lingkungan yang nyata. Selain itu, diperlukan karakterisasi lanjutan seperti *X-ray Photoelectron Spectroscopy* (XPS) untuk mengetahui komposisi kimia pada permukaan dan keadaan oksidasi unsur penyusun MOF sehingga dapat mengetahui mekanisme interaksi kimia antara gugus aktif ekstrak dengan permukaan MOF dan molekul MB. Pengujian *zeta potential* juga diperlukan untuk menentukan muatan permukaan adsorben dan stabilitas dispersi partikel dalam larutan. Selanjutnya, perlu dilakukan uji kemampuan siklus pemakaian ulang adsorben yang berguna untuk potensi keberlanjutan dan efisiensi ekonomi dalam aplikasi jangka panjang.

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