

BAB V

KESIMPULAN DAN SARAN

V.1 Kesimpulan

Berdasarkan hasil penelitian efektivitas MOF Zn-BDC untuk penyerapan zat warna metilen biru, dapat ditarik kesimpulan sebagai berikut:

1. Suhu aktivasi memberikan pengaruh terhadap kapasitas adsorpsi metilen biru terhadap MOF Zn-BDC dimana seiring dengan peningkatan suhu sampai 100°C akan menaikkan kapasitas adsorpsinya hingga mencapai 714,3 mg/g. Kenaikan suhu aktivasi pada suhu 110°C menurunkan kapasitas adsorpsinya (573 mg/g) disebabkan oleh tegangan permukaan pelarut saat penguapan dalam kondisi vakum sehingga terjadi keruntuhan pori. Suhu optimum aktivasi MOF Zn-BDC adalah 100°C.
2. Peningkatan konsentrasi awal metilen biru hingga 1000 ppm menyebabkan peningkatan kapasitas adsorpsi pada semua variasi suhu aktivasi sebagai akibat tingginya *driving force* pada konsentrasi tinggi sehingga mendorong lebih banyak molekul metilen biru untuk berpindah dari larutan ke permukaan adsorben hingga mencapai kondisi jenuh.
3. Hasil analisis kinetika adsorpsi menunjukkan kesesuaian pada model *pseudo-second-order* ($R^2 = 0,9962$) mengindikasikan proses adsorpsi didominasi oleh mekanisme kemisorpsi (*chemisorption*). Sementara hasil isoterm adsorpsi dengan model Sips memberikan kesesuaian terbaik dengan peningkatan kapasitas adsorpsi maksimum (744,4821 mg/g) pada suhu 50°C.
4. Hasil FTIR menunjukkan tidak adanya perubahan pada gugus fungsi setelah aktivasi yang mengindikasikan bahwa aktivasi pada 100°C

hanya menghilangkan pelarut tanpa merusak ikatan koordinasi Zn-ligan. Morfologi Zn-BDC menunjukkan permukaan yang halus dan komposisi unsur menunjukkan adanya C, O, Zn, dan N yang mengonfirmasi keberhasilan sintesis. Hasil XRD menunjukkan tingkat kristalinitas MOF Zn-BDC sebesar 72,3% dan tidak ada perubahan struktur kristal setelah aktivasi. Hasil TGA menunjukkan stabilitas MOF yang baik hingga $\pm 400^{\circ}\text{C}$ dengan dekomposisi utama terjadi pada rentang $400-600^{\circ}\text{C}$ yang disebabkan degradasi ligan organik dan keruntuhan kerangka MOF.

V.2 Saran

Optimasi waktu aktivasi dengan memperpanjang waktu aktivasi agar molekul impuritas menguap lebih sempurna dari dalam pori. Hal ini bertujuan untuk menurunkan persentasi unsur N yang berasal dari pelarut DMF setelah aktivasi MOF dan kapasitas adsorpsi dapat ditingkatkan lebih lanjut. Karakterisasi material yang menyeluruh masih diperlukan pada penelitian selanjutnya untuk melengkapi informasi sifat adsorben yang telah disintesis. Seperti analisa BET dapat dilakukan untuk mengetahui luas permukaan spesifik serta karakteristik pori material untuk mendukung adanya situs aktif yang tersedia setelah proses aktivasi. Selain itu, pengujian menggunakan limbah tekstil asli juga perlu dilakukan untuk menilai kinerja adsorben pada kondisi yang kompleks dibanding larutan sintesis. Pengujian tersebut diharapkan dapat memberikan gambaran yang lebih sesuai mengenai potensi aplikasi adsorben dalam pengolahan air limbah tekstil.

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