BAB V
KESIMPULAN DAN SARAN

5.1 Kesimpulan

Dari penelitian yang telah dilakukan, diperoleh beberapa kesimpulan sebagai berikut:

1. Variasi suhu karbonisasi hidrotermal mempengaruhi *yield hydrochar* yaitu menyebabkan terjadinya penurunan *yield* apabila terjadi peningkatan suhu karbonisasi.
2. *Yield* karbon aktif dipengaruhi oleh penambahan urea dan suhu karbonisasi hidrotermal. Penambahan urea pada metode karbonisasi hidrotermal dan metode pirolisis menyebabkan terjadinya penurunan *yield* karbon aktif. Selain itu, peningkatan suhu karbonisasi hidrotermal menyebabkan terjadinya peningkatan *yield* karbon aktif.
3. Melalui karakterisasi BET, diketahui penambahan urea pada metode karbonisasi hidrotermal dan pirolisis serta peningkatan suhu karbonisasi menyebabkan terjadinya peningkatan luas permukaan, peningkatan total volume pori, peningkatan volume mikropori dan penurunan diameter pori rata-rata.
4. Melalui karakterisasi SEM, diketahui penambahan urea dan peningkatan suhu pada metode karbonisasi hidrotermal menyebabkan semakin banyak terbentuknya pori. Selain itu, penambahan urea juga menyebabkan terjadinya pembentukan struktur yang lebih tipis.
5. Melalui karakterisasi FTIR dan SEM-EDX, diketahui karbon aktif memiliki OFG yang lebih rendah daripada *hydrochar* yang dapat dilihat dari intensitas serapannya dan komposisi komponennya. Komposisi nitrogen dipengaruhi oleh suhu karbonisasi dan proses aktivasi dimana mengalami penurunan ketika suhu karbonisasi meningkat dan menurun juga setelah proses aktivasi berlangsung. Komposisi nitrogen yang paling tinggi diperoleh oleh sampel metode pirolisis.
6. Melalui karakterisasi XRD, diketahui seluruh sampel karbon aktif yang dihasilkan memiliki struktur yang *amorphous*. Struktur dengan %*amorphous* yang paling tinggi dimiliki oleh sampel ACH-225 yaitu sampel metode karbonisasi hidrotermal suhu 225°C tanpa penambahan urea.

5.2 Saran

Dari penelitian yang telah dilakukan, diperoleh beberapa saran yang dapat dipertimbangkan:

1. Perlu dilakukan variasi rasio penambahan urea sehingga dapat diketahui kemungkinan rasio yang lebih baik daripada yang telah diteliti.
2. Perlu dilakukan variasi temperatur pada tahap aktivasi kimia sehingga dapat diperoleh temperatur optimum *N-doped* karbon aktif.
3. Perlu dilakukan karakterisasi XPS (*X-Ray Photoelectron Spectroscopy*) untuk mengetahui kandungan gugus nitrogen dari *N-doped hydrochar* atau *char* dan *N-doped* karbon aktif.
4. Perlu dilakukan karakterisasi elektromia sehingga dapat diketahui kinerja karbon aktif yang paling baik untuk elektroda penyimpan energi.

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