

## BAB V

### KESIMPULAN DAN SARAN

#### 5.1 Kesimpulan

Kesimpulan yang diperoleh dari penelitian ini adalah sebagai berikut :

1. Penambahan  $H_3PO_4$  pada saat karbonisasi hidrotermal menghasilkan *yield* karbon aktif yang lebih banyak bila dibandingkan dengan yang tidak ditambahkan, baik pada variasi suhu aktivasi  $600^\circ C$  maupun  $800^\circ C$ . Selain itu, meningkatnya suhu aktivasi akan menyebabkan penurunan *yield* karbon aktif.
2. Suhu aktivasi berpengaruh pada luas permukaan dan volume pori, namun tidak terlalu besar. Suhu aktivasi  $600^\circ C$  menghasilkan luas permukaan dan volume pori yang lebih besar dibandingkan dengan suhu aktivasi  $800^\circ C$ . Selain itu penambahan  $H_3PO_4$  pada saat karbonisasi hidrotermal menghasilkan luas permukaan dan volume pori yang lebih besar bila dibandingkan dengan karbon aktif tanpa penambahan  $H_3PO_4$ , baik pada variasi suhu aktivasi  $600^\circ C$  maupun  $800^\circ C$ .
3. Morfologi yang dihasilkan dari metode karbonisasi hidrotermal lebih berpori bila dibandingkan dengan metode pirolisis. Selain itu, karbon aktif dengan penambahan  $H_3PO_4$  pada metode karbonisasi hidrotermal menghasilkan morfologi yang lebih berongga dibandingkan dengan karbon aktif tanpa penambahan  $H_3PO_4$ , serta membentuk *microsphere*.
4. Berdasarkan intensitas serapan pada analisis FTIR, karbon aktif yang dihasilkan memiliki OFG yang lebih sedikit bila dibandingkan dengan *hydrochar*, dan didukung dengan komposisi komponen pada hasil analisis SEM-EDX. Selain itu, komposisi atom P pada karbon aktif tidak berpengaruh secara signifikan pada penambahan  $H_3PO_4$  pada karbonisasi hidrotermal, namun pada suhu aktivasi. Semakin tinggi suhu aktivasi, maka komposisi atom P akan semakin besar.
5. Karbon aktif yang dihasilkan, baik dengan metode karbonisasi hidrotermal maupun pirolisis memiliki struktur amorf. Selain itu, struktur paling amorf berada pada sampel AP800, yaitu karbon aktif dengan penambahan  $H_3PO_4$  dan diaktivasi pada suhu  $800^\circ C$ .

6. Metode karbonisasi hidrotermal menghasilkan *yield* dan distribusi pori yang lebih besar bila dibandingkan dengan pirolisis. Karbon aktif hasil dari metode karbonisasi hidrotermal menghasilkan mesopori, sedangkan pirolisis menghasilkan mikropori. Namun dalam hal luas permukaan, pada suhu aktivasi 800°C pirolisis menghasilkan luas permukaan yang lebih besar dibandingkan karbonisasi hidrotermal.

## 5.2 Saran

Saran yang dapat dipertimbangkan dari penelitian ini adalah sebagai berikut:

1. Rasio penambahan  $H_3PO_4$  pada karbonisasi hidrotermal dapat divariasikan untuk mengetahui kemungkinan hasil yang lebih baik.
2. Suhu karbonisasi hidrotermal dapat divariasikan untuk mengetahui suhu optimum karbonisasi limbah akar wangi.
3. Suhu aktivasi dapat dilakukan pada suhu yang lebih rendah dari 600°C untuk mengetahui suhu optimal aktivasi limbah akar wangi.
4. Karakterisasi elektrokimia dapat dilakukan untuk mengetahui kinerja karbon aktif sebagai elektroda penyimpan energi.

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