BAB V
KESIMPULAN DAN SARAN

V.1 Kesimpulan

Berdasarkan penelitian yang telah dilakukan, dapat disimpulkan:

1. Pengaruh penambahan katalis asam sitrat dan variasi konsentrasi katalis asam sitrat terhadap perolehan dan karakteristik *hydrochar* dan karbon aktif dari kulit kakao adalah sebagai berikut.
   a. Perolehan *hydrochar* tanpa menggunakan katalis lebih rendah dibandingkan perolehan *hydrochar* dengan menggunakan katalis. Peningkatan jumlah katalis asam sitrat akan sedikit meningkatkan perolehan *hydrochar*.
   b. Pada analisis BET, penambahan katalis asam sitrat akan menurunkan luas permukaan *hydrochar*-nya namun tidak memberikan pengaruh signifikan terhadap luas permukaan karbon aktifnya.
   c. Pada analisis FTIR, intensitas serapan gugus fungsi kulit kakao lebih kuat dibandingkan *hydrochar*-nya. Selain itu, peningkatan konsentrasi katalis asam sitrat memberikan sedikit pengaruh pada intensitas serapan beberapa gugus fungsi, di mana akan meningkatkan intensitas serapan ikatan O–H dan C=C.
   d. Pada analisis XRD, pada *hydrochar* dan karbon aktif tidak memiliki perbedaan struktur ketika katalis asam sitrat ditambahkan.
2. Pengaruh penambahan katalis asam sitrat dan variasi konsentrasi katalis asam sitrat terhadap perolehan dan karakteristik *hydrochar* dan karbon aktif dari kulit salak adalah sebagai berikut.
   a. Perolehan *hydrochar* tanpa menggunakan katalis lebih rendah dibandingkan perolehan *hydrochar* dengan menggunakan katalis. Peningkatan jumlah katalis asam sitrat akan sedikit meningkatkan perolehan *hydrochar*.
   b. Pada analisis BET, penambahan katalis asam sitrat tidak memberikan pengaruh pada luas permukaan *hydrochar*-nya, namun meningkatkan luas permukaan pada karbon aktifnya.
   c. Pada analisis FTIR, intensitas serapan gugus fungsi kulit salak lebih kuat dibandingkan *hydrochar*-nya dan intensitas serapan gugus fungsi *hydrochar* lebih kuat dibandingkan karbon aktifnya. Peningkatan konsentrasi katalis asam

sitrat memberikan sedikit pengaruh pada intensitas serapan beberapa gugus fungsi, di mana akan menurunkan intensitas serapan ikatan C–O pada *hydrochar* serta menurunkan intensitas serapan ikatan O–H dan C–O pada karbon aktif.

d. Pada analisis XRD, pada *hydrochar* dan karbon aktif tidak memiliki perbedaan struktur ketika katalis asam sitrat ditambahkan.

e. Pada *Raman Spectroscopy*, penambahan katalis asam sitrat menghasilkan *degree of disorder* yang semakin tinggi.

f. Pada analisis SEM, *hydrochar* memiliki bentuk morfologi yang mirip dengan kulit salak dan muncul tonjolan yang semakin banyak ketika jumlah katalis yang digunakan semakin banyak. Sedangkan, karbon aktif memiliki bentuk seperti terumbu karang dengan rongga yang semakin banyak ketika jumlah katalis ditingkatkan.

V.2 Saran

Berdasarkan penelitian yang telah dilakukan, terdapat saran yang dapat dipertimbangkan untuk penelitian berikutnya, yaitu:

1. Menggunakan temperatur operasi yang lebih rendah atau waktu operasi yang lebih rendah (apabila memungkinkan) pada proses karbonisasi hidrotermal serta menggunakan katalis dengan rentang jumlah yang lebih luas untuk melihat pengaruh katalis secara lebih signifikan.

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