BAB V

KESIMPULAN DAN SARAN

5.1 Kesimpulan

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

1. Suhu karbonisasi hidrotermal mempengaruhi *yield hydrochar* yang dihasilkan dari limbah biomassa. Semakin tinggi suhu maka *yield hydrochar* yang dihasilkan semakin kecil.
2. Penambahan $ZnCl_2$ dan urea sebagai katalis dan *doping* secara bersamaan pada proses karbonisasi hidrotermal menghasilkan DES (*Deep Eutectic Solvent*) yang mempengaruhi *yield hydrochar* yang dihasilkan. DES bersifat sebagai pelarut yang melarutkan lignin secara keseluruhan dan menambah senyawa ZnO yang berasal dari $ZnCl_2$ yang terlarut.
3. *Yield* karbon aktif dipengaruhi oleh penambahan urea dan katalis serta suhu karbonisasi hidrotermal. Karbon aktif yang diberi urea tanpa katalis memiliki *yield* lebih besar dibandingkan dengan katalis. Selain itu, peningkatan suhu karbonisasi hidrotermal menyebabkan terjadinya peningkatan *yield* karbon aktif.
4. Melalui karakterisasi BET, diketahui bahwa penambahan urea baik dengan atau tanpa katalis sebagai *doping* pada metode karbonisasi hidrotermal menyebabkan terjadinya peningkatan luas permukaan, peningkatan total volume pori, dan penurunan diameter pori rata-rata dibandingakan dengan karbon aktif komersial.
5. Melalui karakterisasi BET, diketahui bahwa penambahan urea dengan katalis meningkatkan volume pori dan luas permukaan namun tidak sebesar karbon aktif yang hanya diberi *doping* ataupun diberi katalis saja.
6. Melalui karakterisasi FTIR, diketahui karbon aktif memiliki OFG yang lebih rendah daripada *hydrochar* dan CPH yang dilihat dari intensitas serapannya. Komposisi nitrogen dipengaruhi oleh suhu karbonisasi dan penambahan katalis dimana ketika sampel karbon aktif yang diberi *doping* dan katalis intensitas nitrogen cenderung lebih bsar dibandingkan tanpa katalis.

7. Melalui karakterisasi XRD, diketahui seluruh sampel karbon aktif yang memiliki La dan Lc yang paling besar adalah sampel ACHNK3-200 yaitu penambahan *doping* dengan katalis. La dan Lc ini dipengaruhi *dspacing* yang diakibatkan tumpukan grafit pada permukaan karbon aktif

Saran

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

1. Perlu dilakukan variasi rasio penambahan urea dan $ZnCl_2$ sehingga dapat diketahui kemungkinan rasio yang lebih baik daripada yang telah diteliti.
2. Perlu dilakukan karakterisasi SEM-EDX (*Scanning Electron Microscope-Energy Dispersive X-Ray*) untuk mengatuhi kandungan senyawa pada karbon aktif dan *hydrochar*.
3. Perlu dilakukan karakterisasi XPS (*X-Ray Photoelectron Spectroscopy*) untuk mengatuhi kandungan gugus nitrogen dari *N-doped hydrochar* atau *char* dan *N-doped* karbon aktif.

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