



## BAB V

### KESIMPULAN DAN SARAN

#### 5.1 Kesimpulan

Setelah melakukan penelitian pada pembuatan katalis asam heterogen berbasis komposit karbon silika dengan proses hidrotermal satu tahap serta dengan melakukan variasi pada jumlah penambahan asam *P-toluene sulfonic* (TsOH) dan support *Tetraethyl Orthosilicate* (TEOS), diperoleh beberapa kesimpulan dari penelitian ini, yaitu:

Sintesis katalis dengan menggunakan asam *P-toluene sulfonic* (TsOH) sebagai agen sulfonasi dan *Tetraethyl Orthosilicate* (TEOS) sebagai support melalui proses hidrotermal satu tahap, menghasilkan katalis asam heterogen berbasis komposit karbon silika.

1. Proses karbonisasi selama 48 jam, membuat banyak gugus  $-SO_3H$  dapat menempel dengan baik pada permukaan katalis asam heterogen yang disintesis.
2. Nilai konversi terbesar pada reaksi esterifikasi antara asam asetat dan butanol menjadi butil asetat sebesar 95,07%, dengan variasi jumlah asam *P-toluene Sulfonic* (TsOH) dan *Tetraethyl Orthosilicate* (TEOS) sebanyak 3 gram.
3. Semakin besar jumlah asam *P-toluene Sulfonic* (TsOH), maka nilai konversi reaksi esterifikasi asam asetat dan butanol menjadi butil asetat semakin besar.
4. Semakin besar jumlah support *Tetraethyl Orthosilicate* (TEOS), maka nilai konversi reaksi esterifikasi asam asetat dan butanol menjadi butil asetat semakin besar.
5. Nilai *acid site density* terbesar pada katalis komposit karbon silika sebesar 2,75 mmol/g dengan variasi jumlah asam *P-toluene Sulfonic* (TsOH) sebanyak 3 gram dan tanpa ada penambahan *Tetraethyl Orthosilicate* (TEOS).
6. Nilai *acid site density* pada katalis meningkat seiring dengan naiknya jumlah asam *P-toluene Sulfonic* (TsOH).
7. Nilai *acid site density* pada katalis menurun seiring dengan naiknya jumlah support *Tetraethyl Orthosilicate* (TEOS).

## 5.2 Saran

Adapun beberapa saran yang dapat diberikan untuk penelitian selanjutnya, yaitu:

1. Penggunaan asam *P-toluene Sulfonic* (TsOH) dapat dipertahankan untuk meningkatkan nilai konversi dari reaksi esterifikasi asam asetat dan butanol menjadi butil asetat.
2. Penggunaan asam *P-toluene Sulfonic* (TsOH) dapat dipertahankan untuk meningkatkan nilai *acid site density* pada katalis.
3. Memastikan bahwa pada saat pencucian, katalis benar-benar terbebas dari komponen-komponen yang tidak diinginkan.
4. Proses karbonisasi hidrotermal sebaiknya dilakukan pada suasana asam.



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