**List of Tables**

**Table 1.** Independent variables and their levels used in the response surface design.

**Table 2.** Experimental results of the response surface methodology.

**Table 3.** ANOVA for response surface quadratic model analysis of variance.

**Table 1**

|  |  |  |
| --- | --- | --- |
| **Variables** | **Code** | **Levels** |
|  |  | **-1** | **0** | **+1** |
| MeOH:PC molar ratio | X1 | 6 | 10 | 14 |
| Catalyst loading (%)(w/w) | X2 | 1.5 | 2.5 | 3.5 |
| Reaction temperature (K) | X3 | 403 | 433 | 463 |
| Reaction time (h) | X4 | 2 | 4 | 6 |
| Stirring speed (rpm) | X5 | 300 | 400 | 500 |

**Table 2**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Run | A | B | C | D | E | PC conversiona (%) | PC conversionb(%) | DMC yielda(%) | DMC yieldb(%) |
| 1 | 14:1 | 2.5 | 433 | 4 | 300 | 73 | 70.3 | 70 | 67.7 |
| 2 | 14 | 1.5 | 433 | 4 | 400 | 49 | 47.6 | 48 | 46.7 |
| 3 | 10 | 2.5 | 433 | 2 | 300 | 35.5 | 38 | 33.7 | 35.6 |
| 4 | 10 | 2.5 | 433 | 4 | 400 | 76.2 | 76.2 | 72.2 | 72.2 |
| 5 | 10 | 2.5 | 463 | 4 | 500 | 69.5 | 67.2 | 67.3 | 64.8 |
| 6 | 10 | 1.5 | 433 | 6 | 400 | 52 | 50.1 | 49.3 | 47.8 |
| 7 | 10 | 2.5 | 433 | 2 | 500 | 35.5 | 37.9 | 33.6 | 36.1 |
| 8 | 10 | 1.5 | 463 | 4 | 400 | 44.9 | 44.4 | 42.8 | 42.4 |
| 9 | 6 | 2.5 | 433 | 2 | 400 | 14.2 | 12.6 | 13.7 | 12.2 |
| 10 | 10 | 3.5 | 403 | 4 | 400 | 14.9 | 16.5 | 13.8 | 14.9 |
| 11 | 6 | 1.5 | 433 | 4 | 400 | 25 | 26.5 | 23.8 | 24.8 |
| 12 | 10 | 2.5 | 463 | 2 | 400 | 25.6 | 22.2 | 24.2 | 21 |
| 13 | 10 | 1.5 | 403 | 4 | 400 | 9.1 | 8.1 | 8.6 | 7.3 |
| 14 | 10 | 2.5 | 463 | 6 | 400 | 74 | 76.3 | 70.8 | 72.8 |
| 15 | 10 | 2.5 | 403 | 4 | 300 | 21.9 | 24.7 | 20.6 | 23.2 |
| 16 | 10 | 1.5 | 433 | 2 | 400 | 20.9 | 22.9 | 19.5 | 21.5 |
| 17 | 10 | 2.5 | 433 | 4 | 400 | 76.2 | 76.2 | 72.2 | 72.2 |
| 18 | 10 | 3.5 | 433 | 6 | 400 | 74 | 72.2 | 70 | 68.3 |
| 19 | 6 | 2.5 | 463 | 4 | 400 | 29 | 28 | 26.5 | 25.9 |
| 20 | 6 | 2.5 | 433 | 4 | 300 | 40.9 | 41.3 | 38.3 | 38.9 |
| 21 | 6 | 3.5 | 433 | 4 | 400 | 34.1 | 34.2 | 32 | 31.9 |
| 22 | 10 | 2.5 | 403 | 2 | 400 | 3.1 | 2.2 | 2.2 | 1.6 |
| 23 | 10 | 3.5 | 463 | 4 | 400 | 63.2 | 65.4 | 59.9 | 61.9 |
| 24 | 10 | 2.5 | 403 | 4 | 500 | 22 | 22.8 | 20.7 | 21.2 |
| 25 | 10 | 1.5 | 433 | 4 | 500 | 52.9 | 53.7 | 50.3 | 51.3 |
| 26 | 14 | 2.5 | 433 | 6 | 400 | 72 | 75.3 | 71.1 | 73.8 |
| 27 | 6 | 2.5 | 433 | 6 | 400 | 35.1 | 36.7 | 33 | 34 |
| 28 | 10 | 3.5 | 433 | 2 | 400 | 28.2 | 30.2 | 26.3 | 28 |
| 29 | 10 | 2.5 | 433 | 4 | 400 | 76.2 | 76.2 | 72.2 | 72.1 |
| 30 | 14 | 2.5 | 433 | 2 | 400 | 30 | 30.1 | 28.8 | 29 |
| 31 | 10 | 2.5 | 463 | 4 | 300 | 65.9 | 65.5 | 62.1 | 61.7 |
| 32 | 14 | 3.5 | 433 | 4 | 400 | 72 | 69.2 | 69 | 66.6 |
| 33 | 6 | 2.5 | 433 | 4 | 500 | 40.1 | 42.2 | 38.4 | 40 |
| 34 | 10 | 3.5 | 433 | 4 | 300 | 69.1 | 68.5 | 64.8 | 64.2 |
| 35 | 10 | 2.5 | 403 | 6 | 400 | 12.5 | 14.2 | 11.7 | 13.2 |
| 36 | 10 | 2.5 | 433 | 6 | 300 | 75.2 | 72.6 | 71.2 | 68.8 |
| 37 | 10 | 1.5 | 433 | 4 | 300 | 52.9 | 53.5 | 50.3 | 50.7 |
| 38 | 10 | 2.5 | 433 | 4 | 400 | 76.2 | 76.2 | 72.2 | 72.2 |
| 39 | 14 | 2.5 | 403 | 4 | 400 | 12.1 | 13.4 | 11.7 | 13.1 |
| 40 | 10 | 2.5 | 433 | 4 | 400 | 76.2 | 76.2 | 72.2 | 72.2 |
| 41 | 10 | 3.5 | 433 | 4 | 500 | 68.5 | 68.1 | 64.9 | 64.8 |
| 42 | 14 | 2.5 | 463 | 4 | 400 | 68.3 | 71.5 | 67.1 | 70.1 |
| 43 | 14 | 2.5 | 433 | 4 | 500 | 70.3 | 69.3 | 69.2 | 67.8 |
| 44 | 6 | 2.5 | 403 | 4 | 400 | 3.9 | 3 | 3 | 2 |
| 45 | 10 | 2.5 | 433 | 6 | 500 | 75.2 | 72.6 | 71.2 | 69.5 |
| 46 | 10 | 2.5 | 433 | 4 | 400 | 76.2 | 76.2 | 72.1 | 72.1 |

A: MeOH:PC molar ratio

B: Catalyst loading [%][w/w]

C: Reaction temperature [K]

D: Reaction time [h]

E: Stirring speed [rpm]

a: Experimentally obtained

b: Predicted by model

**Table 3**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Sum of squares | Degrees of freedom | Mean square | *F* value | *p*-value |
| Model | 25219.9 | 20 | 1261.0 | 246.3 | < 0.0001 hs |
| A | 3195.4 | 1 | 3195.4 | 624.2 | < 0.0001 hs |
| B | 729.9 | 1 | 729.9 | 142.6 | < 0.0001 hs |
| C | 6741.8 | 1 | 6741.8 | 1316.9 | < 0.0001 hs |
| D | 4429.9 | 1 | 4429.9 | 865.3 | < 0.0001 hs |
| E | 1.3 | 1 | 1.3 | 0.3 | 0.621 ns |
| AB | 41.2 | 1 | 41.2 | 8.0 | 0.008 s |
| AC | 255.2 | 1 | 255.2 | 49.8 | < 0.0001 hs |
| AD | 131.9 | 1 | 131.9 | 25.8 | < 0.0001 hs |
| AE | 0.2 | 1 | 0.2 | 0.0 | 0.843 ns |
| BC | 35.4 | 1 | 35.4 | 6.9 | 0.0144 s |
| BD | 48.6 | 1 | 48.6 | 9.5 | 0.0049 s |
| BE | 0.0 | 1 | 0.0 | 0.0 | 0.988 ns |
| CD | 344.5 | 1 | 344.5 | 67.3 | < 0.0001 hs |
| CE | 6.4 | 1 | 6.4 | 1.3 | 0.272 ns |
| DE | 0.0 | 1 | 0.0 | 0.0 | 0.982 ns |
| A2 | 2489.5 | 1 | 2489.5 | 486.3 | < 0.0001 hs |
| B2 | 1418.9 | 1 | 1418.9 | 277.2 | < 0.0001 hs |
| C2 | 6734.7 | 1 | 6734.7 | 1315.5 | < 0.0001 hs |
| D2 | 2828.6 | 1 | 2828.6 | 552.5 | < 0.0001 hs |
| E2 | 23.8 | 1 | 23.8 | 4.6 | 0.04 s |

A: MeOH:PC molar ratio

B: Catalyst loading [%][w/w]

C: Reaction temperature [K]

D: Reaction time [h]

E: Stirring speed [rpm]

s: significant

ns: not significant

hs: highly significant