Tab. 1: Selected independents variables and their interval limits for alkali-catalyzed transesterification of rapeseed oil

| label | Independent variables | | Bottom limit | Upper limit |
|---|---|---|---|---|
| $X_1$ | *m.r.* | molar ratio of methanol to oil [-] | 4.5 : 1 | 6.0 : 1 |
| $X_2$ | $\alpha_{KOH}$ | empiric coefficient of catalyst [-] | 0.0064 | 0.0085 |
| $X_3$ | $\omega_{emulg}$ | revolution of emulgation attachment [rpm] | 12 000 | 22 000 |
| $X_4$ | *stir.* | stirrer [-] | no | yes |
| $X_5$ | $t_{emulg}$ | time of emulgation before reaction [min] | 15 | 25 |
| $X_6$ | $T_R$ | reaction temperature [°C] | 40.7 | 62 |
| $X_7$ | $t_R$ | reaction time [min] | 25 | 45 |

Tab. 2: Detailed experimental plan for independent variables

| number of experiment | *m.r.* [-] | $\alpha_{KOH}$ [-] | $\omega_{emulg}$ [rpm] | *stir.* [-] | $t_{emulg}$ [min] | $T_R$ [°C] | $t_R$ [min] |
|---|---|---|---|---|---|---|---|
| 1 | 6.0:1 | 0.0085 | 22 000 | no | 25 | 40.7 | 25 |
| 2 | 4.5:1 | 0.0085 | 22 000 | yes | 15 | 62.0 | 25 |
| 3 | 4.5:1 | 0.0065 | 22 000 | yes | 25 | 40.7 | 45 |
| 4 | 6.0:1 | 0.0065 | 12 000 | yes | 25 | 62.0 | 25 |
| 5 | 4.5:1 | 0.0075 | 12 000 | no | 25 | 62.0 | 45 |
| 6 | 6.0:1 | 0.0065 | 22 000 | no | 15 | 62.0 | 45 |
| 7 | 6.0:1 | 0.0085 | 12 000 | yes | 15 | 40.7 | 45 |
| 8 | 4.5:1 | 0.0065 | 12 000 | no | 15 | 40.7 | 25 |
| 9 | 4.5:1 | 0.0065 | 22 000 | no | 15 | 40.7 | 25 |
| 10 | 4.5:1 | 0.0061 | 22 000 | yes | 15 | 62.0 | 25 |
| 11 | 5.1:1 | 0.0061 | 22 000 | no | 15 | 40.7 | 25 |
| 12 | 4.5:1 | 0.0061 | 17 000 | yes | 15 | 40.7 | 25 |
| 13 | 4.5:1 | 0.0065 | 22 000 | no | 15 | 40.7 | 25 |
| 14 | 2.0:1 | 0.0065 | 12 000 | yes | 25 | 62.0 | 25 |

Tab. 3: Verification of the model: chosen and calculated variables

| | | | | | |
|---|---|---|---|---|---|
| chosen variables | $\alpha_{KOH}$ [-] | $Y_1$ (yield of EP) [g/g] | $Y_3$ (viscosity) [mm$^2$/s] | $Y_4$ (conversion) [wt-%] | $Y_6$ (CCI) [wt-%] |
| | 0.0064 | 0.985 | 4.66 | 98.5 | 0.017 |
| calculated variables | *m.r.* [-] | $T_r$ [°C] | $\omega_{emulg}$ [rpm] | $t_r$ [min] | |
| | 5.7 : 1 | 62 | 18 130 | 41 | |

Tab. 4: Verification of the model: comparison of predicted and experimental values (experimental value is 100 %)

| value | $Y_1$ (yield of EP) [g/g] | $Y_3$ (viscosity) [$mm^2/s$] | $Y_4$ (conversion) [wt-%] | $Y_6$ (CCI) [wt-%] |
|---|---|---|---|---|
| pred. | 0.985 | 4.66 | 98.5 | 0.017 |
| exper. | 0.966 | 4.65 | 99 | 0.018 |
| corr. [%] | 101.2 | 99.8 | 100.5 | 94.4 |