

Day 3 Homework Exercise 2

Double your impact by getting started with Design of Experiments (DoE)

Analyzing a 20-Run Custom Design

Questions:

1. Open the file, and use the Model script to fit the model. Which terms are significant? (Use a significance level of 0.05 and remove interactions first.)
2. Slowly reduce this model by removing non-significant terms ($P\text{Value} > 0.05$). Remove interactions first. How many terms are in the reduced model?
3. Use the Prediction Profiler to find settings of the factors that maximize Percent Reacted. What are the settings, and what is the predicted response at these settings?
4. Interpret the bracketed values for the predicted Percent Reacted. What do these values represent?

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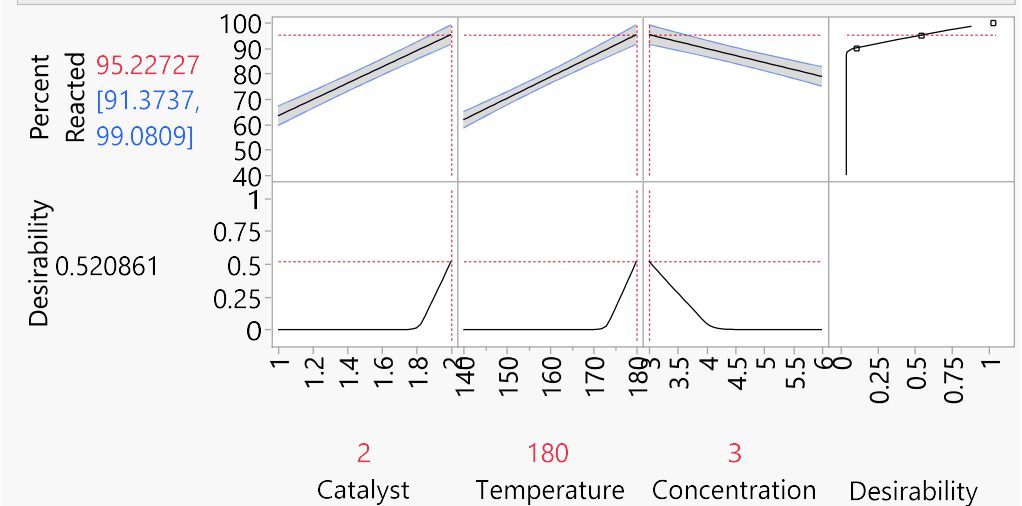
Effect Summary

Source	LogWorth	PValue
Catalyst(1,2)	3.246	0.00057
Catalyst*Temperature	2.429	0.00372
Temperature(140,180)	2.292	0.00511 ^
Temperature*Concentration	2.134	0.00734
Concentration(3,6)	1.483	0.03291 ^
Feed Rate*Concentration	0.362	0.43489
Stir Rate*Concentration	0.316	0.48301
Feed Rate*Temperature	0.286	0.51729
Catalyst*Concentration	0.286	0.51729
Catalyst*Stir Rate	0.286	0.51729
Feed Rate(10,15)	0.147	0.71365 ^
Stir Rate*Temperature	0.121	0.75725
Feed Rate*Catalyst	0.037	0.91746
Stir Rate(100,120)	0.026	0.94097 ^
Feed Rate*Stir Rate	0.016	0.96455

Effect Summary

Source	LogWorth	PValue
Catalyst(1,2)	9.176	0.00000
Catalyst*Temperature	6.423	0.00000
Temperature(140,180)	5.998	0.00000 ^
Temperature*Concentration	5.615	0.00000
Concentration(3,6)	3.341	0.00046 ^

Prediction Profiler



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Solutions:

1. Open the file, and use the Model script to fit the model. Which terms are significant? (Use a significance level of 0.05 and remove interactions first)

The terms **Catalyst**, **Catalyst*Temperature**, **Temperature**, **Temperature*Concentration**, and **Concentration** are significant.

2. Slowly reduce this model by removing non-significant terms ($P\text{Value} > 0.05$). Remove interactions first. How many terms are in the reduced model?

The same five terms are in the reduced model: three main effects and two 2-way interactions.

3. Use the Prediction Profiler to find settings of the factors that maximize Percent Reacted. What are the settings, and what is the predicted response at these settings?

(Hint: Click the red triangle for the **Prediction Profiler**, select **Optimization and Desirability**, and then select **Maximize Desirability**.) The settings are **Catalyst (2)**, **Temperature (180)**, and **Concentration (3)**. At these settings, the predicted **Percent Reacted** is 95.227.

4. Interpret the bracketed values for the predicted Percent Reacted. What do these values represent?

The bracketed values (91.37 to 99.08) are a 95% confidence interval for the mean **Percent Reacted** at the optimal settings. Assuming that the process is stable and that other factors can be controlled, you can be confident that the mean **Percent Reacted** will be in this range.