Summary of Statistical Analysis

I conducted statistical analyses to better understand the factors influencing plastic degradation, represented by the variable "y" measured in uM/min. I investigated the effects of two independent variables: "substrate" (with two categories: pNOB and NPO) and "sub_conc_level" (with eight concentration levels).

Analysis 1: Two-Way ANOVA

To start, I performed a Two-Way Analysis of Variance (ANOVA) to examine how "substrate" and "sub_conc_level" influence plastic degradation. Initially, the assumptions of normality and equal variance were not met, so I transformed "y" to log(y) to address this issue.

The Two-Way ANOVA results revealed significant effects for both "substrate" and "sub_conc_level," as well as their interaction. This means that both factors individually and in combination have a significant impact on plastic degradation rates.

*EXTRA: Run post-hoc test

Here are the pairs of concentration levels that are NOT significantly different from each other (adj p-value >0.05):

(0.05 & 0.025)
(0.1 & 0.025)
(0.2 & 0.025)
(0.1 & 0.05)
(0.2 & 0.05)
(0.2 & 0.1)
(0.003125 & 0.0015625)

This means that when it comes to how these concentrations affect the outcome we're studying, they are quite similar and don't stand out as significantly different from each other.

Analysis 2: Multiple Regression without Interaction (assesses the main effects of each variable on the plastic degradation rate)

Model fit: 68.94% of the variation in plastic degradation can be explained by the variance in substrate and concentration level.

pNOB is statistically significant: the coefficient 107.291 uM/min means using pNOB results in an increase of 107.291 uM/min in the degradation rate (y) compared to NPO.

sub_conc_level:

* 0.003125, 0.00625, 0.0125: are not statistically significant, thus no effect on the degradation rate (y)
* 0.025, 0.05. 0.1, 0.2: are statistically significant, 0.05 is the most effective concentration level because it results in the highest increase in y among the tested levels (97.548 uM/min)

Analysis 3: Regression with Interaction Term (captures the joint effects of both variables on the plastic degradation rate)

Model fit: The model's overall fit is excellent, with an Adjusted R-squared value of 0.9909. This indicates that the model explains approximately 99.09% of the variance in the plastic degradation rate. This model also produce the lowest residuals standard errors (7.808)

These substrate and concentration level combination are statistically significant:
substratepNOB:sub_conc_level0.00625
substratepNOB:sub_conc_level0.0125
substratepNOB:sub_conc_level0.025
substratepNOB:sub_conc_level0.05
substratepNOB:sub_conc_level0.1
substratepNOB:sub_conc_level0.2

substratepNOB:sub_conc_level0.2 has the most pronounced impact on y with the highest coefficient of 210.9173 uM/min. This suggests that when using pNOB as the substrate in combination with a concentration level of 0.2, it leads to the most significant increase in plastic degradation rates compared to other combinations