ANOVA for Quadratic model

Response 2: Insolubility

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	8600.50	9	955.61	46.26	< 0.0001	significant
A-Water	46.13	1	46.13	2.23	0.1787	
B-Sucrose	307.52	1	307.52	14.89	0.0062	
C-Gelatin	7498.84	1	7498.84	362.99	< 0.0001	
AB	9.21	1	9.21	0.4459	0.5257	
AC	32.04	1	32.04	1.55	0.2531	
BC	23.38	1	23.38	1.13	0.3227	
A^2	1.15	1	1.15	0.0559	0.8199	
B^2	27.72	1	27.72	1.34	0.2847	
C^2	668.09	1	668.09	32.34	0.0007	
Residual	144.61	7	20.66			
Lack of Fit	139.44	3	46.48	36.00	0.0024	significant
Pure Error	5.17	4	1.29			
Cor Total	8745.11	16				

Factor coding is **Coded**.
Sum of squares is **Type III - Partial**

The **Model F-value** of 46.26 implies the model is significant. There is only a 0.01% chance that an F-value this large could occur due to noise.

P-values less than 0.0500 indicate model terms are significant. In this case B, C, C^2 are significant model terms. Values greater than 0.1000 indicate the model terms are not significant. If there are many insignificant model terms (not counting those required to support hierarchy), model reduction may improve your model.

The **Lack of Fit F-value** of 36.00 implies the Lack of Fit is significant. There is only a 0.24% chance that a Lack of Fit F-value this large could occur due to noise. Significant lack of fit is bad -- we want the model to fit.

Fit Statistics

Std. Dev.	4.55	R^2	0.9835
Mean	45.55	Adjusted R^2	0.9622
C.V. %	9.98	Predicted R^2	0.7439
		Adeq Precision	21.1224

The **Predicted R^2** of 0.7439 is not as close to the **Adjusted R^2** of 0.9622 as one might normally expect; i.e. the difference is more than 0.2. This may indicate a large block effect or a possible problem with your model and/or data. Things to consider are model reduction, response transformation, outliers, etc. All empirical models should be tested by doing confirmation runs.

Adeq Precision measures the signal to noise ratio. A ratio greater than 4 is desirable. Your ratio of 21.122 indicates an adequate signal. This model can be used to navigate the design space.

Model Comparison Statistics

PRESS	2239.19
-2 Log Likelihood	84.64
BIC	112.97
AICc	141.30

Coefficients in Terms of Coded Factors

Factor	Coefficient Estimate	df	Standard Error	95% CI Low	95% CI High	VIF
Intercept	50.03	1	2.03	45.22	54.83	
A-Water	-2.40	1	1.61	-6.20	1.40	1.0000
B-Sucrose	6.20	1	1.61	2.40	10.00	1.0000
C-Gelatin	30.62	1	1.61	26.82	34.42	1.0000
AB	1.52	1	2.27	-3.86	6.89	1.0000
AC	-2.83	1	2.27	-8.20	2.54	1.0000
BC	-2.42	1	2.27	-7.79	2.96	1.0000
A^2	0.5235	1	2.22	-4.71	5.76	1.01
B^2	2.57	1	2.22	-2.67	7.80	1.01
C^2	-12.60	1	2.22	-17.83	-7.36	1.01

The coefficient estimate represents the expected change in response per unit change in factor value when all remaining factors are held constant. The intercept in an orthogonal design is the overall average response of all the runs. The coefficients are adjustments around that average based on the factor settings. When the factors are orthogonal the VIFs are 1; VIFs greater than 1 indicate multi-colinearity, the higher the VIF the more severe the correlation of factors. As a rough rule, VIFs less than 10 are tolerable.

Final Equation in Terms of Coded Factors

Insolubility	=
+50.03	
-2.40	A
+6.20	B
+30.62	C
+1.52	AB
-2.83	AC
-2.42	BC
+0.5235	A^2
+2.57	B^2
-12.60	C^2

The equation in terms of coded factors can be used to make predictions about the response for given levels of each factor. By default, the high levels of the factors are coded as +1 and the low levels are coded as -1. The coded equation is useful for identifying the relative impact of the factors by comparing the factor coefficients.

Final Equation in Terms of Actual Factors

Insolubility	=
-12.17622	
-0.274515	Water
-0.206368	Sucrose
+5.82132	Gelatin
+0.007226	Water * Sucrose
-0.014513	Water * Gelatin
-0.013283	Sucrose * Gelatin
+0.002327	$Water^2$
+0.013092	$Sucrose^2$
-0.074536	$Gelatin^2$

The equation in terms of actual factors can be used to make predictions about the response for given levels of each factor. Here, the levels should be specified in the original units for each factor. This equation should not be used to determine the relative impact of each factor because the coefficients are scaled to accommodate the units of each factor and the intercept is not at the center of the design space.