ANOVA for Quadratic model

Response 1: Gel strength

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	627.63	9	69.74	177.82	< 0.0001	significant
A-Water	3.14	1	3.14	8.01	0.0254	
B-Sucrose	13.30	1	13.30	33.91	0.0006	
C-Gelatin	587.36	1	587.36	1497.66	< 0.0001	
AB	1.12	1	1.12	2.87	0.1343	
AC	0.9497	1	0.9497	2.42	0.1636	
BC	0.0641	1	0.0641	0.1635	0.6980	
A^2	4.16	1	4.16	10.60	0.0139	
B^2	2.38	1	2.38	6.08	0.0431	
C^2	16.28	1	16.28	41.52	0.0004	
Residual	2.75	7	0.3922			
Lack of Fit	2.71	3	0.9045	113.48	0.0003	significant
Pure Error	0.0319	4	0.0080			
Cor Total	630.38	16				

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

The **Model F-value** of 177.82 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 A, B, C, A^2, B^2, 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 113.48 implies the Lack of Fit is significant. There is only a 0.03% 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.	0.6262	R^2	0.9956
Mean	10.81	Adjusted R^2	0.9900
C.V. %	5.79	Predicted R^2	0.9311
		Adeq Precision	41.0479

The **Predicted R^2** of 0.9311 is in reasonable agreement with the **Adjusted R^2** of 0.9900; i.e. the difference is less than 0.2.

Adeq Precision measures the signal to noise ratio. A ratio greater than 4 is desirable. Your ratio of 41.048 indicates an adequate signal. This model can be used to navigate the design space.

Model Comparison Statistics

PRESS	43.46
-2 Log Likelihood	17.25
BIC	45.58
AICc	73.91

Coefficients in Terms of Coded Factors

Factor	Coefficient Estimate	df	Standard Error	95% CI Low	95% CI High	VIF
Intercept	10.91	1	0.2801	10.25	11.57	
A-Water	-0.6265	1	0.2214	-1.15	-0.1029	1.0000
B-Sucrose	1.29	1	0.2214	0.7657	1.81	1.0000
C-Gelatin	8.57	1	0.2214	8.05	9.09	1.0000
AB	0.5302	1	0.3131	-0.2102	1.27	1.0000
AC	-0.4873	1	0.3131	-1.23	0.2532	1.0000
BC	0.1266	1	0.3131	-0.6138	0.8670	1.0000
A^2	0.9937	1	0.3052	0.2721	1.72	1.01
B^2	0.7526	1	0.3052	0.0309	1.47	1.01
C^2	-1.97	1	0.3052	-2.69	-1.24	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

Gel strength	=
+10.91	
-0.6265	A
+1.29	B
+8.57	C
+0.5302	AB
-0.4873	AC
+0.1266	BC
+0.9937	A^2
+0.7526	B^2
-1.97	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

Gel strength =

+7.64917

-0.449793 Water

-0.194617 Sucrose

+1.15257 Gelatin

+0.002525 Water * Sucrose

-0.002499 Water * Gelatin

+0.000696 Sucrose * Gelatin

+0.004417 Water^2

+0.003840 Sucrose^2

-0.011636 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.