

Supporting Information for Publication

Process Optimization by Response Surface Methodology for Transesterification of Renewable Ethyl Acetate to Butyl Acetate Biofuel Additive over Borated USY Zeolite

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Table S1. The Box-Behnken design matrix of the three process variables in coded units and the experimental and predicted response values.

Run	Process variables in coded units			Yield of <i>n</i> -Butyl Acetate, Y (%)	
	X ₁	X ₂	X ₃	Experimental	Predicted
1	0	0	0	87	87
2	0	+	+	97	96
3	0	0	0	87	87
4	-	+	0	54	55.5
5	0	-	-	66	67
6	0	0	0	87	87
7	0	-	+	75	75
8	-	-	0	52	52.5
9	+	0	-	63	63.5
10	0	+	-	55	55
11	0	0	0	87	87
12	-	0	+	56	55.5
13	0	0	0	87	87
14	-	0	-	42	40.5
15	+	0	+	96	97.5
16	+	-	0	85	83.5
17	+	+	0	90	89.5

Table S2. ANOVA for response surface quadratic model.

Source	Sum of squares	Df	Mean square	F-value	p-value Prob > F	
Model	4998.24	9	555.36	323.96	< 0.0001	significant
X ₁	2112.5	1	2112.5	1232.29	< 0.0001	
X ₂	40.5	1	40.5	23.63	0.0018	
X ₃	1200.5	1	1200.5	700.29	< 0.0001	
X ₁ X ₂	2.25	1	2.25	1.31	0.2896	
X ₁ X ₃	90.25	1	90.25	52.65	0.0002	
X ₂ X ₃	272.25	1	272.25	158.81	< 0.0001	
X ₁ ²	697.96	1	697.96	407.14	< 0.0001	
X ₂ ²	63.22	1	63.22	36.88	0.0005	
X ₃ ²	410.59	1	410.59	239.51	< 0.0001	
Residual	12.0	7	1.71			
Lack of Fit	12.0	3	4.0			
Pure Error	0	4	0			
Cor Total	5010.24	16				

R² = 0.9976; R²-adjusted = 0.9945; R²-predicted = 0.9617; CV = 1.76%