

## Supplementary Information

### Continuous Synthesis of a Green Fuel Additive Mixture with Highest Quantities of Solketalacetin and Solketal and Lowest Amount of Diacetin from Biodiesel-Derived Glycerol

*Yadollah M. Gorji and Hassan S. Ghaziaskar\**

*Department of Chemistry, Isfahan University of Technology, 84156-83111 Isfahan, Iran*

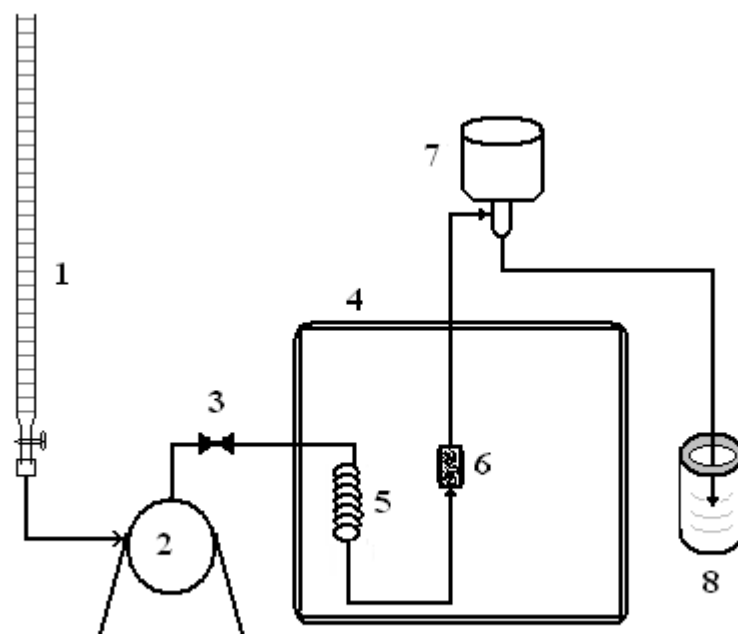
**Table S1.** Estimated regression coefficients obtained by ANOVA to determine independent variable that statistically significant

Term	Coefficient	Standard error	<i>t</i> -Value	<i>p</i> -Value
Constant	-58.9909	13.4570	-4.384	0.000
X	40.7974	3.5906	11.362	0.000
T	1.0769	0.2055	5.239	0.000
F	8.6612	3.4398	2.518	0.020
P	0.1542	0.0634	2.431	0.024
X <sup>2</sup>	-4.1641	0.3793	-10.980	0.000
T <sup>2</sup>	-0.0038	0.0009	-4.058	0.001
F <sup>2</sup>	-4.6566	1.5171	-3.069	0.006
X*T	-0.1281	0.0255	-5.025	0.000
X*P	-0.0575	0.0204	-2.819	0.010

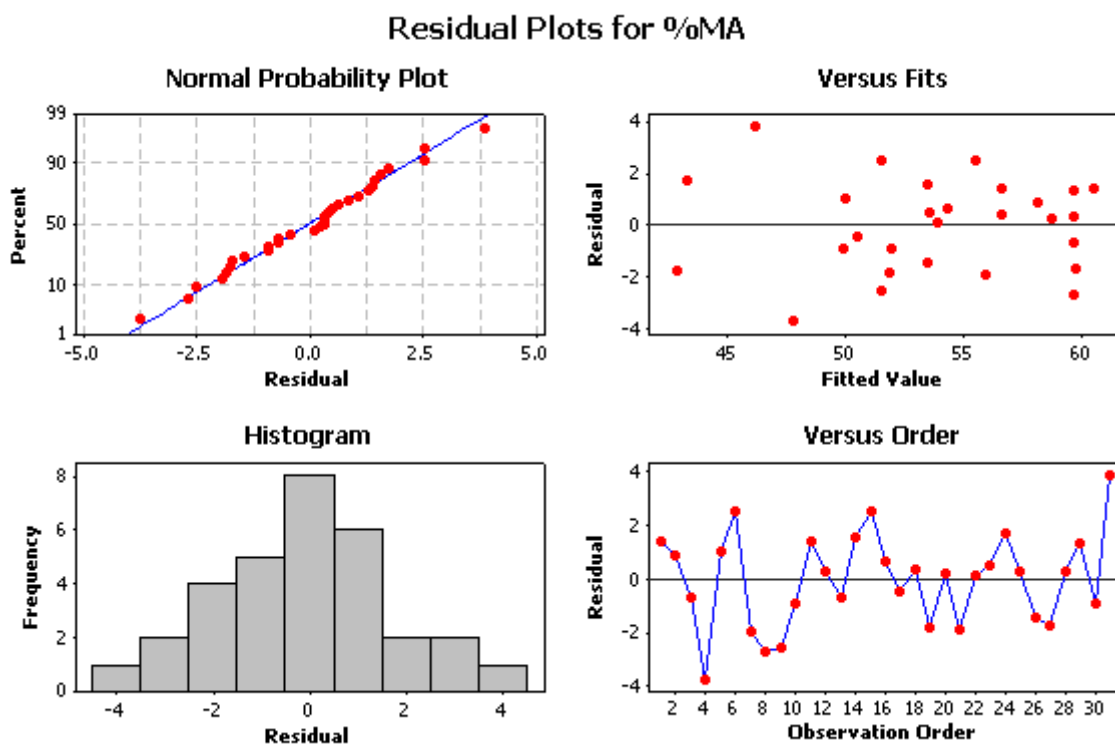
**Table S2.** Response analysis of variance to determine the validity of the model

Source	Degrees of freedom	Sum of squares	Mean square	<i>F</i> -Value	<i>p</i> -Value
Regression	9	767.730	85.303	20.50	0.000
Residual error	21	87.367	4.160		
Lack-of-fit	15	77.653	5.177	3.20	0.080
Pure	6	9.714	1.619		
Total	30	855.097			

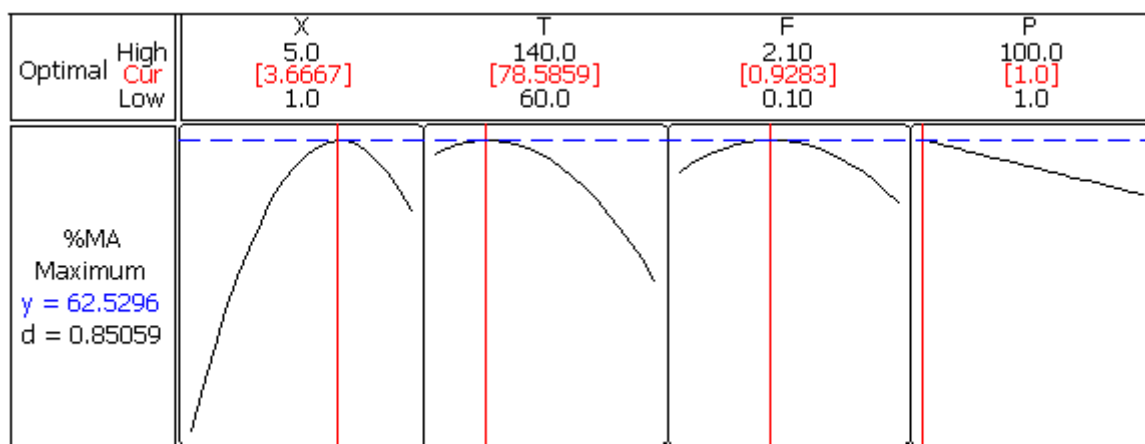
\*e-mail: ghazi@cc.iut.ac.ir



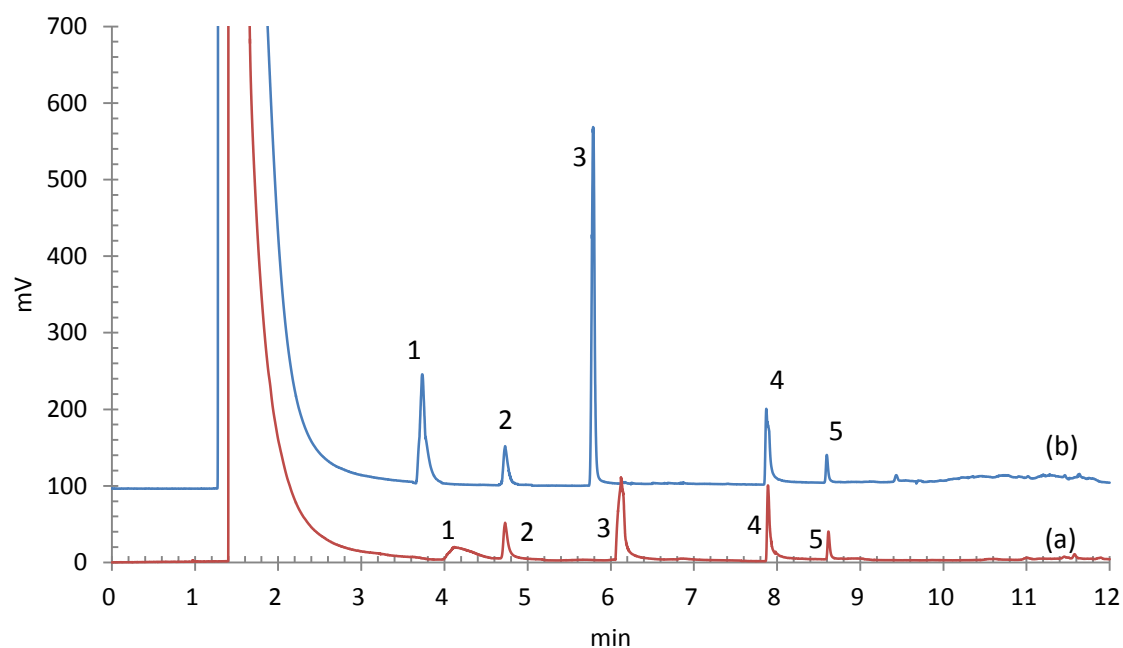
**Figure S1.** Schematic diagram of the setup used for the reaction of glycerol and acetic acid; (1) feedstock reservoir; (2) HPLC pump; (3) on-off valve; (4) oven; (5) preheating coil; (6) reactor; (7) back-pressure regulator; and (8) sample collection vessel.



**Figure S2:** Four residual plots for the obtained and predicted monoacetin yield in the experimental design.



**Figure S3.** Optimization plots of yield ( $y$ ) versus different variables mentioned at the top row of the figure. The maximum and minimum values for each variable (in black) and the optimum values (in red) are in upper row and the effect of each variable can be seen on the lower row.



**Figure S4.** (a) GC-FID chromatogram of the solution under stage 1 optimum condition: (1) residual glycerol = 30%; (2) internal standard; (3) monoacetin = 62%; (4) diacetin = 8%; and (5) triacetin = less than 1%; (b) GC-FID chromatogram of the solution obtained under stage 2 optimum condition (final solution): (1) solketal = 30%; (2) internal standard; (3) solketalacetin = 62%; (4) diacetin = 8%; and (5) triacetin = less than 1%.