

**UCC Library and UCC researchers have made this item openly available.
Please [let us know](#) how this has helped you. Thanks!**

Title	Optimization of surfactant addition in cellulosic ethanol process using integrated techno-economic and life cycle assessment for bioprocess design
Author(s)	Kadhun, Haider Jawad; Rajendran, Karthik; Murthy, Ganti S.
Publication date	2018-10-04
Original citation	Kadhun, H. J., Rajendran, K. and Murthy, G. S. (2018) 'Optimization of surfactant addition in cellulosic ethanol process using integrated techno-economic and life cycle assessment for bioprocess design', ACS Sustainable Chemistry and Engineering, 6(11), pp. 13687-13695. doi:10.1021/acssuschemeng.8b00387
Type of publication	Article (peer-reviewed)
Link to publisher's version	http://dx.doi.org/10.1021/acssuschemeng.8b00387 Access to the full text of the published version may require a subscription.
Rights	© 2018, American Chemical Society. This document is the Accepted Manuscript version of a Published Work that appeared in final form in ACS Sustainable Chemistry and Engineering after technical editing by the publisher. To access the final edited and published work see https://pubs.acs.org/doi/abs/10.1021/acssuschemeng.8b00387
Embargo information	Access to this article is restricted until 12 months after publication by request of the publisher.
Embargo lift date	2019-10-04
Item downloaded from	http://hdl.handle.net/10468/7155

Downloaded on 2021-11-29T17:47:47Z

Optimization of Surfactant Addition in Cellulosic Ethanol Process Using Integrated Techno-Economic and Life Cycle Assessment for Bioprocess Design

Haider Jawad Kadhum ^{a,b,§}, Karthik Rajendran ^{a,c,d,§}, Ganti S. Murthy ^{a,*}

^a Department of Biological and Ecological Engineering, Oregon State University, Corvallis OR-97331, United States

^b College of Agriculture, Al-Qasim Green University, Babylon, Iraq

^c Environmental Research Institute, MaREI centre, University College Cork, Cork, Ireland

^d School of Engineering, University College Cork, Cork, Ireland

§ Both the authors had contributed equally to this manuscript

Emails: kadhumb@oregonstate.edu; karthik.1988@gmail.com, k.rajendran@ucc.ie;
Ganti.Murthy@oregonstate.edu

*Corresponding author:

Ganti.Murthy@oregonstate.edu

Phone: +1 (541) 737 6291

Fax: +1 (541) 737 2082

Supplementary 3

Figure S3:S1: Effect of surfactants on glucose release in the 1st experiment.

Factor	Type	Levels	Values
Surfactant %	fixed	4	0, 2, 5, 8
Surfactant Type	fixed	5	PEG3000, PEG4000, PEG6000, PEG8000, Tween

Analysis of Variance for Glucose, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Surfactant %	3	5392.62	5392.62	1797.54	20.17	0.000
Surfactant Type	4	392.69	392.69	98.17	1.10	0.400
Surfactant %*Surfactant Type	12	1069.41	1069.41	89.12	2.52	0.014
Error	40	1414.05	1414.05	35.35		
Total	59	8268.77				

S = 5.94569 R-Sq = 82.90% R-Sq(adj) = 74.78%

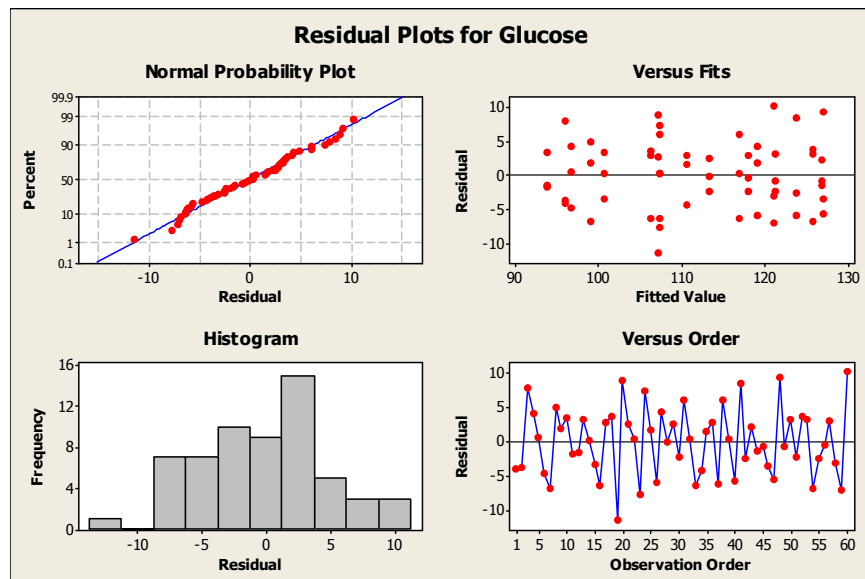


Figure S3:S2: Effect of surfactants on ethanol production in the 1st experiment.

Factor	Type	Levels	Values
Surfactant %	fixed	4	0, 2, 5, 8
Surfactant Type	fixed	5	PEG3000, PEG4000, PEG6000, PEG8000, Tween

Analysis of Variance for Ethanol, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Surfactant %	3	2307.68	2307.68	769.23	40.10	0.000
Surfactant Type	4	150.91	150.91	37.73	1.97	0.118
Surfactant %*Surfactant Type	12	127.63	127.63	10.64	0.55	0.865
Error	40	767.24	767.24	19.18		
Total	59	3353.45				

S = 4.37962 R-Sq = 77.12% R-Sq(adj) = 66.25%

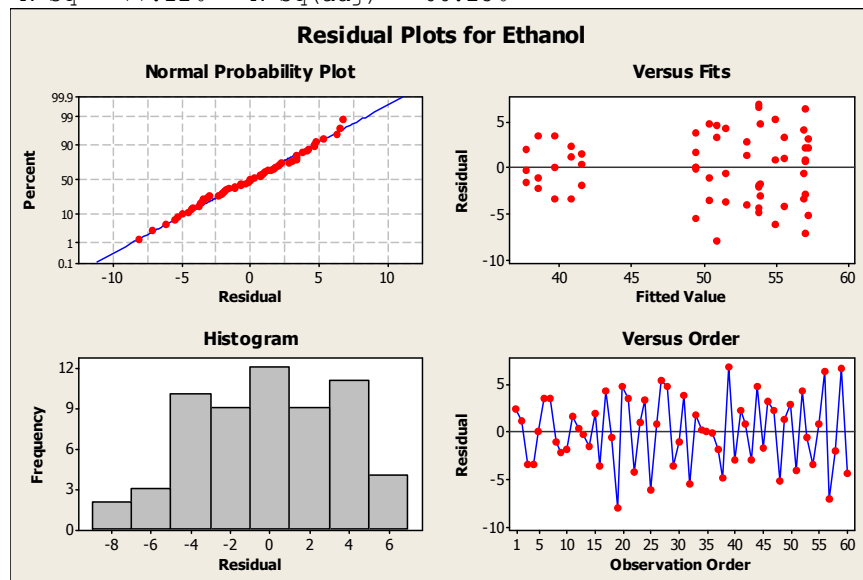


Figure S3:S3: Effect of PEG 6000 on glucose release in the 2nd experiment.

Source	DF	SS	MS	F	P
PEG 6000	4	387.5	96.9	1.41	0.299
Error	10	685.7	68.6		
Total	14	1073.2			

S = 8.281 R-Sq = 36.11% R-Sq(adj) = 10.55%

Individual 95% CIs For Mean Based on Pooled StDev

Level	N	Mean	StDev
PEG 0%	3	82.07	9.15
PEG 0.25%	3	92.66	4.60
PEG 0.5%	3	89.22	10.17
PEG 0.75%	3	92.08	10.51
PEG 1%	3	97.54	4.91

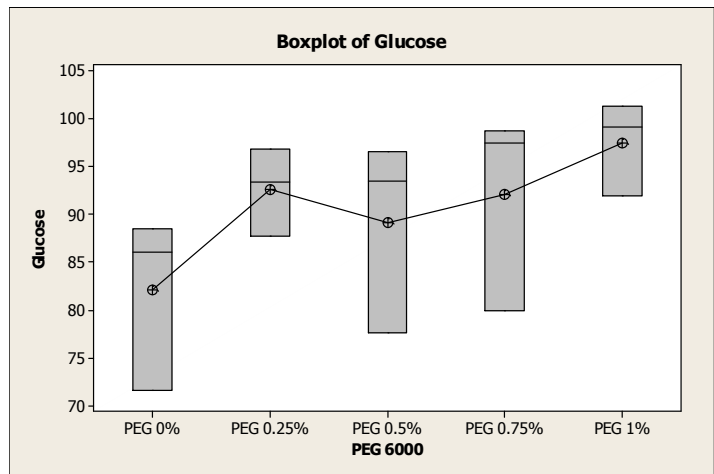


Figure S3:S5: Two sample T-Test comparing control and PEG 1%.

Two-sample T for control vs PEG 1%

	N	Mean	StDev	SE Mean
control	3	38.59	1.09	0.63
PEG 1%	3	42.49	1.43	0.82

Difference = mu (control) - mu (PEG 1%)

Estimate for difference: -3.91

95% CI for difference: (-7.21, -0.60)

T-Test of difference = 0 (vs not =): T-Value = -3.76 P-Value = 0.033 DF = 3

