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Authors	Kadhum, Haider Jawad;Rajendran, Karthik;Murthy, Ganti S.
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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: kadhumh@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%
```

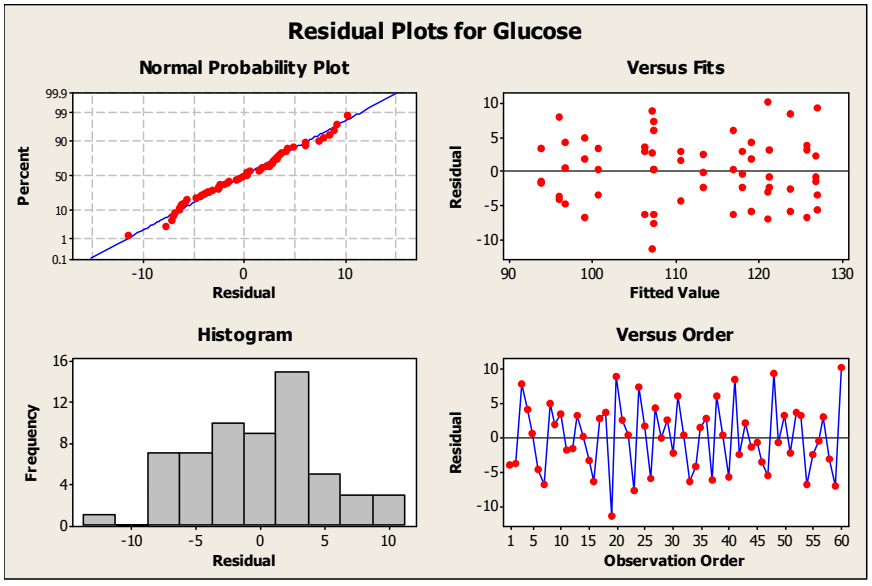


Figure S3:S2: Effect of surfactants on ethanol production in the 1st experiment.

```
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%
```

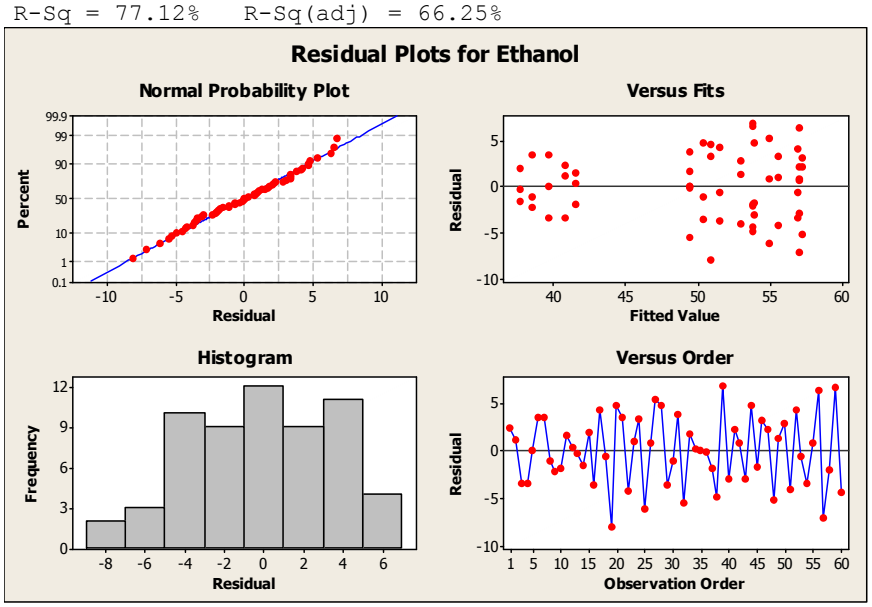


Figure S3:S3: Effect of PEG 6000 on glucose release in the 2nd experiment.

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%

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

Individual 95% CIs For Mean Based on Pooled StDev

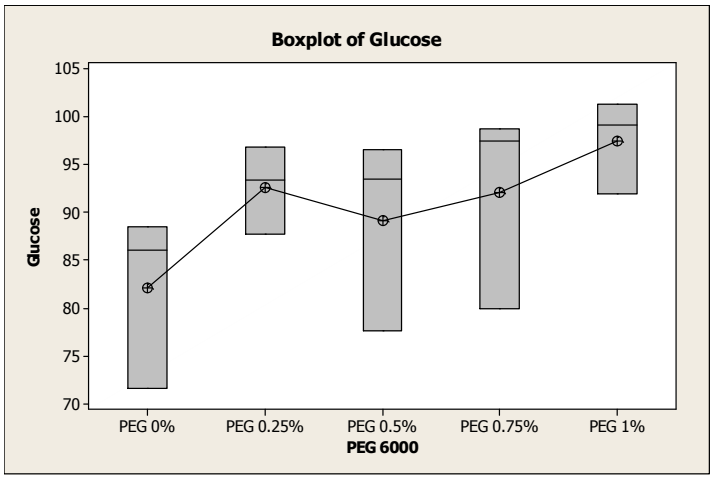


Figure S3:S4: Effect of PEG 6000 on ethanol production in the 2nd experiment.

Source	DF	SS	MS	F	P
PEG 6000	4	23.66	5.92	3.81	0.039
Error	10	15.54	1.55		
Total	14	39.20			

S = 1.246 R-Sq = 60.37% R-Sq(adj) = 44.51%

Level	N	Mean	StDev
PEG 0%	3	38.586	1.094
PEG 0.25%	3	40.128	0.918
PEG 0.5%	3	40.806	1.297
PEG 0.75%	3	40.683	1.418
PEG 1%	3	42.492	1.427

Individual 95% CIs For Mean Based on Pooled StDev

```
-----+---------+---------+---------+----
(-------*-------)
        (-------*-------)
           (-------*-------)
          (-------*-------)
                   (-------*-------)
-----+---------+---------+---------+----
  38.0      40.0      42.0      44.0
```

Pooled StDev = 1.246

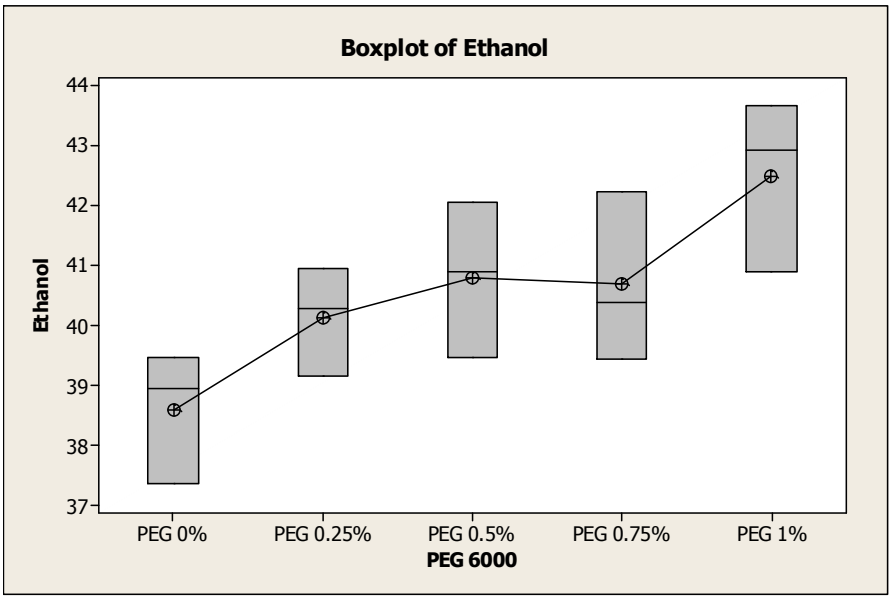


Figure S3:S5: Two sample T-Test comparing control and PEG 1%.

```
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
```

