***Supplementary Information***

# SBA-15 supported ionic liquid phase (SILP) with $H_2PW_{12}O_{40}^-$ for the hydrolytic catalysis of red macroalgal biomass to sugars

Lenny B. Malihan, Grace M. Nisola, Neha Mittal, Seong Poong Lee, Jeong Gil Seo, Hern Kim, Wook-Jin Chung*

*Energy and Environment Fusion Technology Center ($E^2FTC$), Department of Energy Science and Technology (DEST), Myongji University, 116 Myongji-ro, Cheoin-gu, Yongin City, Gyeonggido 17058, South Korea*

*Corresponding Author: Tel.: +82-31-330-6687, Fax: +82-31-337-2902

E-mail: wjc0828@gmail.com

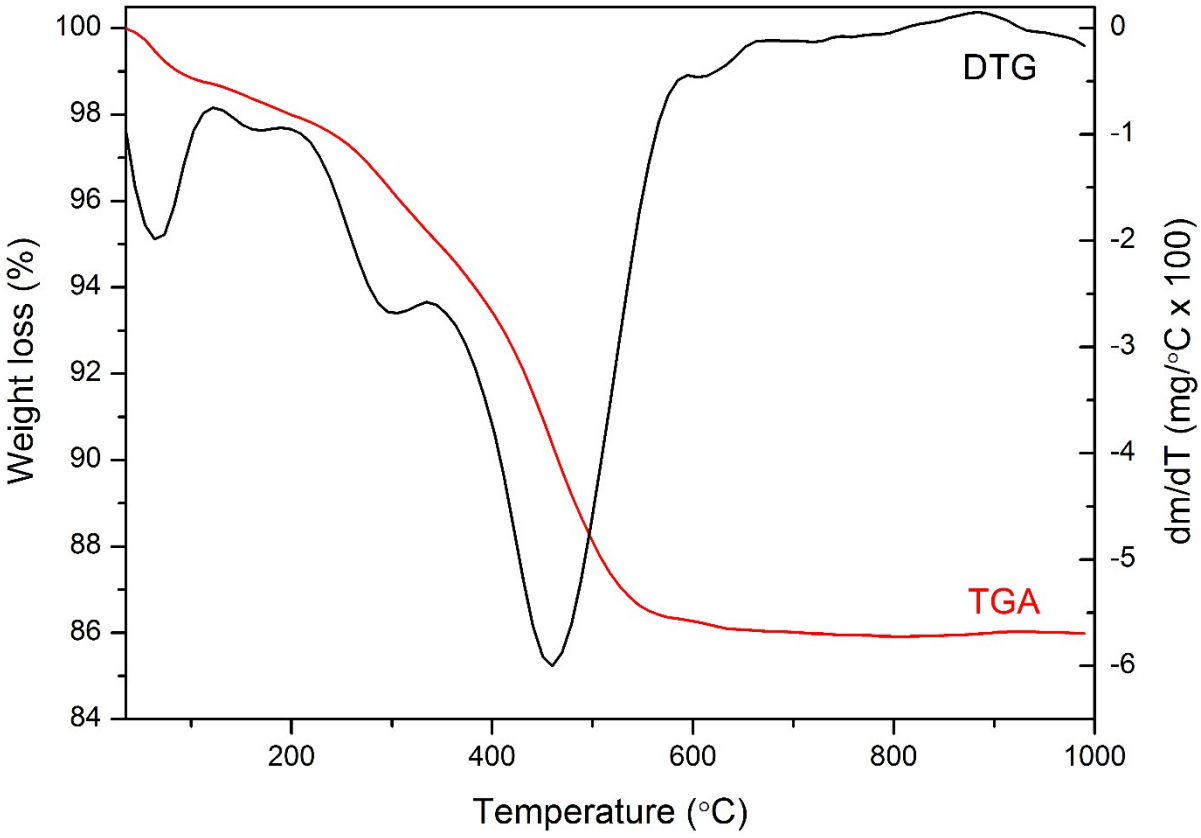
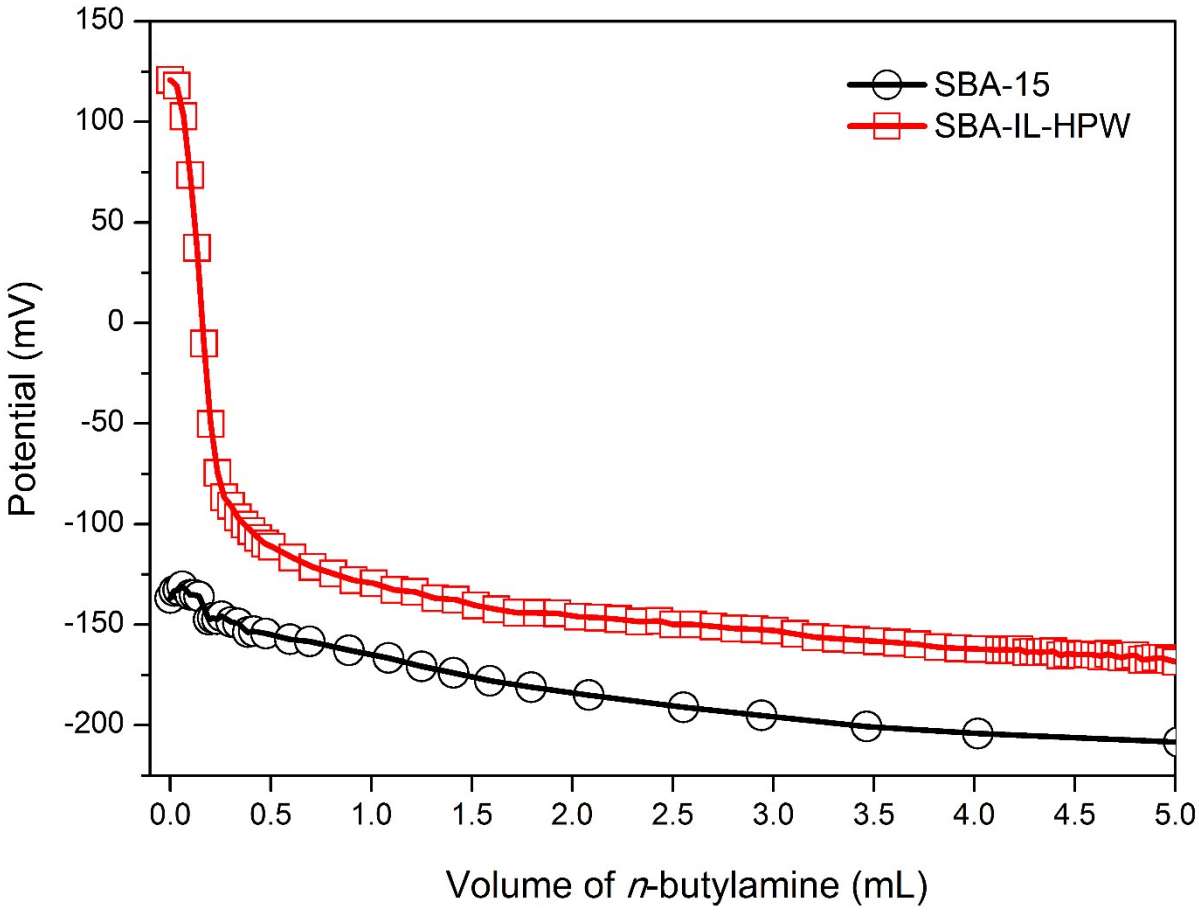



**Fig. S1** TGA/DTG curve of SBA-IL-HPW.




1

2 **Fig. S2** Potentiometric titration curves of SBA-15 and SBA-IL-HPW using *n*-butylamine.

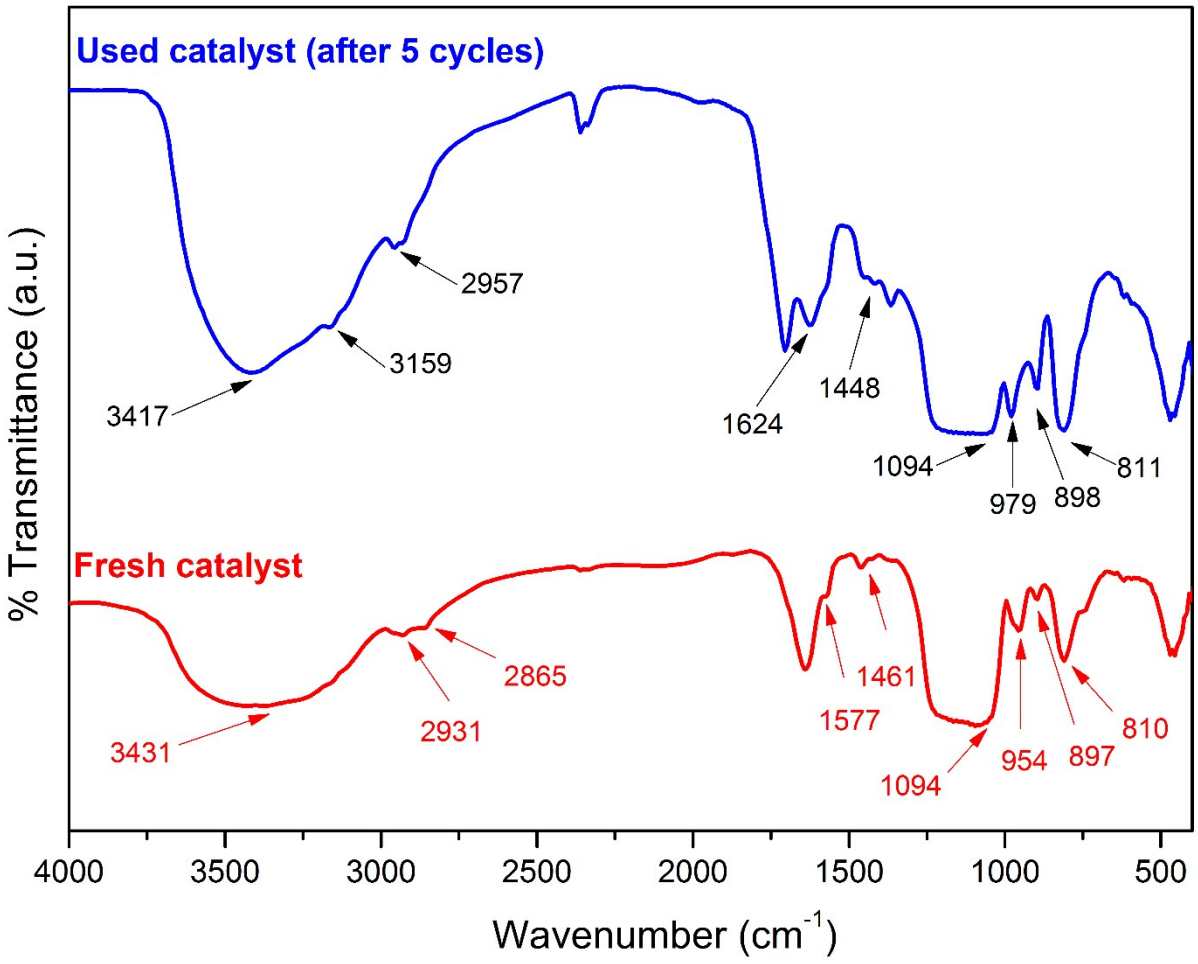



**Fig. S3.** FT-IR spectra of fresh SBA-IL-HPW and used catalyst after 5 hydrolytic cycles.

**Table S1.** Galactose yields and decomposition products from the hydrolysis of agarose using SBA-IL-HPW.[a]

| Time (hr) | Galactose yield (wt%) | Decomposition products | | |
|---|---|---|---|---|
| | | 5-HMF | Formic acid | Levulinic acid |
| 3 | 1.86 ± 0.42 | 3.26 ± 0.29 | 0 | 0 |
| 6 | 69.63 ± 0.99 | 248.91 ± 11.22 | 0 | 0 |
| 12 | 72.85 ± 4.55 | 251.22 ± 8.68 | 27.66 ± 0.10 | 0 |
| 24 | 70.75 ± 1.34 | 166.73 ± 14.60 | 54.57 ± 0.51 | 8.02 ± 0.94 |

[a]Reaction conditions: 50 mg agarose, 60 mg SBA-IL-HPW, 5 mL DI water, 120 °C, autoclave.

**Table S2.** Glucose yields and decomposition products from the hydrolysis of cellobiose using SBA-IL-HPW.[b]

| Time (hr) | Glucose yield (wt%) | Decomposition products | | |
|---|---|---|---|---|
| | | 5-HMF | Formic acid | Levulinic acid |
| 6 | 28.67 ± 1.74 | 4.32 ± 0.47 | 0 | 0 |
| 12 | 58.22 ± 0.80 | 12.21 ± 1.28 | 0 | 0 |
| 18 | 57.43 ± 0.05 | 18.44 ± 0.93 | 67.79 ± 0.71 | 1.78 ± 0.15 |
| 24 | 32.38 ± 2.59 | 20.06 ± 1.85 | 177.32 ± 5.76 | 275.84 ± 11.15 |

[b]Reaction conditions: 50 mg cellobiose, 60 mg SBA-IL-HPW, 5 mL DI water, 140 °C, autoclave.

**Table S3.** Sugar yields and decomposition products from the hydrolysis of *G. amansii* using SBA-IL-HPW.[c]

| Time (hr) | Total reducing sugar (wt%) | Galactose yield (wt%) | Decomposition products | |
|---|---|---|---|---|
| | | | 5-HMF | Formic acid |
| 3 | 16.68 ± 3.24 | 0.96 ± 0.06 | 0 | 0 |
| 6 | 44.7 ± 1.75 | 20.59 ± 0.27 | 38.06 ± 1.85 | 0 |
| 12 | 55.3 ± 3.87 | 38.44 ± 2.38 | 67.81 ± 5.14 | 18.54 ± 0.69 |
| 24 | 55.77 ± 3.33 | 37.4 ± 1.35 | 46.18 ± 2.74 | 35.04 ± 5.59 |

[c]Reaction conditions: 50 mg *G. amansii*, 60 mg SBA-IL-HPW, 5 mL DI water, 120 °C, autoclave.

**Table S4.** Galactose yields in autoclaved water.*

| **Leaching Cycle** | **Galactose yield (wt%)** |
|---|---|
| 1 | 13.73 |
| 2 | 4.11 |
| 3 | 2.35 |
| 4 | 2.19 |

* Used as a leaching solvent of SBA-IL-HPW sample. A pre-weighed sample of SBA-IL-HPW was repeatedly autoclaved in fresh water (several cycles). For each leaching cycle, the autoclaved water was collected after filtration, loaded with agarose, and then re-autoclaved for the hydrolysis reaction.