Supporting Information

Sub-Pilot-Scale Autocatalytic Pyrolysis of Wastewater Biosolids for Enhanced Energy Recovery

Zhongzhe Liu¹, Simcha Singer², Daniel Zitomer¹, and Patrick McNamara^{1,*}

- ¹ Department of Civil, Construction and Environmental Engineering, Marquette University, Milwaukee, Wisconsin 53233, United States; zhongzhe.liu@marquette.edu (Z.L.); daniel.zitomer@marquette.edu (D.Z.)
- ² Department of Mechanical Engineering, Marquette University, Milwaukee, Wisconsin 53233, United States; simcha.singer@marquette.edu (S.S.)
- * Correspondence: patrick.mcnamara@marquette.edu (P.M.); Tel.: +1-414-288-2188

	Major Element										
	С	Н	Ν	S	0	Mg	Ca	Р	Fe	Si	Al
Content (wt% dry basis)	36.52	4.62	7.18	1.09	26.21	1.39	5.44	3.96	10.11	4.97	1.23

Table S1. Elemental analysis of Milorganite[®] (wt% dry basis)



Figure S1. Process diagram of the autocatalytic pyrolysis of biosolids [1].



Figure S2. Product yields and optical properties of the sub-pilot-scale test

and the bench-scale test (500 °C)



Figure S3. Bio-oil optical property from the sub-pilot-scale tests. "control" denotes the experiment without catalyst and the downstream temperature was 500 °C, 0.5 and 1 represent catalyst to biosolids mass ratios.)



Figure S4. Bio-oil and py-gas energy contents ("control" denotes the 800 °C non-catalytic test with the downstream temperature of 500 °C; "0.5" and "1" indicate the 800 °C downstream autocatalytic tests performed with a catalyst/biosolids mass ratio of 0.5 and 1, respectively; The bench-scale results were from our previous study [1].)



Figure S5. The picture of the sub-pilot-scale pyrolytic system with key units highlighted

(Highlighted in Picture 1: downstream cylindrical reactor with ceramic heater; in Picture 2: downstream reactor and detachable condensing system; in Picture 3: ventilation tubing to the building roof; in Picture 4: downstream reactor, detachable condensing system, and extended ventilation tubing with a bird view from the roof; in Picture 5: powered draft fan for ventilation; in Picture 6: downstream cylindrical reactor housed by ceramic heater).

References

1. Liu, Z.; McNamara, P.; Zitomer, D. Autocatalytic Pyrolysis of Wastewater Biosolids for Product Upgrading. *Environ. Sci. Technol.* **2017**, *51*, 9808–9816, doi:10.1021/acs.est.7b02913.