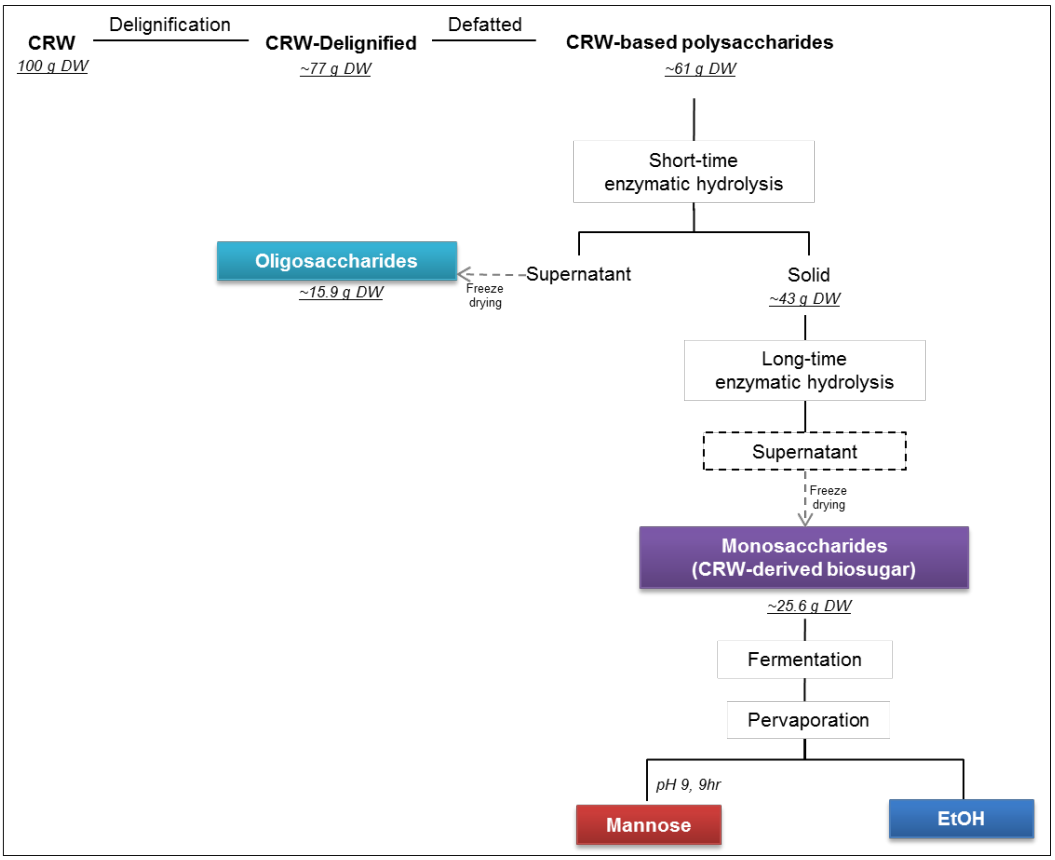
Abstract preparation for NAXOS 2018 Conference
Title: Integrated process produces valuable mannose oligosaccharides, mannose and ethanol from coffee residue waste

Q.A. Nguyen[1], H-J. Bae[1, 2*]

[1]Bioenergy Research Center, Chonnam National University, Gwangju 500-757, Republic of Korea
[2]Department of Bioenergy Science and Technology, Chonnam National University, Gwangju 500-757, Republic of Korea
*Corresponding author email: baehj@chonnam.ac.kr (H.-J. Bae).
Presenting author email: quynhanhnqhc@gmail.com (Q.A. Nguyen).
Keywords: Coffee residue waste, delignification, defatted, enzymatic hydrolysis, mannose, oligosaccharides.

Abstract
Coffee residue waste (CRW), or spent coffee ground (SCG), is abundant and widely available in the world, which typically could pose serious environment problems if directly discharging into the environment without treatments. The integrative process using industrial waste, CRW-based mannose and bioethanol production offers promising economic potential through diversified new values and low bioresource. Previously, we proved that CRW was not only an excellent source for mannose and bioethanol production (Nguyen *et al*., 2017), but also may be use as source for valuable oligosaccharides (Ballesteros *et al*., 2018; Tian *et al*., 2017). In this research, we novelty develop an integrated process using pretreated CRW to produce mannose oligosaccharides, biosugars (mixture of monosugars or mannose, in particularly), and bioethanol. First of the process, CRW is pretreated through 2 steps, delignification and defatted, respectively, to produce CRW-based polysaccharides ground, which then be hydrolyzed by enzymes. The enzymatic hydrolysis step is performed via two-stages hydrolysis, short-time and long-time enzymatic hydrolysis, to produce short chained oligosaccharides and monosaccharides, respectively. In the short-time hydrolysis stage, pretreated-CRW is hydrolyzed by small amount of only in-house produced cellulase in a short time period, then the mixtures of oligosaccharides are harvested in the supernatant, whereas the solid is collected for long-time enzymatic hydrolysis. In the long-time hydrolysis stage, the remained solid of the pretreated-CRW is hydrolyzed by an efficient amount of mixture of in-house produced cellulase and β-glucosidase to produce monosaccharides that mainly includes mannose, galactose, and glucose, with highly purity due to using CRW-based polysaccharides ground as raw materials. From 100 g (DW) of CRW, under optimized conditions throughout the process includes delignification, defatted, short-time and long-time enzymatic hydrolysis, amount of approximately 77 g (DW) CRW-delignified, approximately 61 g (DW) CRW-delignified-defatted (CRW-based polysaccharides), approximately 15.9 g (DW) of mannose oligosaccharides (mainly includes mannobiose and mannotriose), and approximately 25.6 g (DW) of CRW-derived biosugar (mainly includes mannose, galactose, and glucose), respectively, have been recovered. Due to high purity, usage of CRW-derived biosugar to produce mannose and bioethanol may give more advances in comparison to former research (Nguyen *et al*., 2017), such as: higher purity makes easier controllable in fermentation process, limits loss of monosugars (no need color removal by activated carbon powder), less impact to permeate membrane, and improves mannose quality.



Acknowledgements: This work was supported by Priority Research Centers Program (2010-0020141) through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology, Republic of Korea.

References:

Ballesteros, L.F., Cerqueira, M.A., Teixeira, J.A., Mussatto, S.I. 2018. Production and physicochemical properties of carboxymethyl cellulose films enriched with spent coffee grounds polysaccharides. *International Journal of Biological Macromolecules*, **106**(Supplement C), 647-655.

Nguyen, Q.A., Cho, E., Trinh, L.T.P., Jeong, J.-s., Bae, H.-J. 2017. Development of an integrated process to produce d-mannose and bioethanol from coffee residue waste. *Bioresource Technology*, **244, Part 1**, 1039-1048.

Tian, T., Freeman, S., Corey, M., German, J.B., Barile, D. 2017. Chemical Characterization of Potentially Prebiotic Oligosaccharides in Brewed Coffee and Spent Coffee Grounds. *Journal of Agricultural and Food Chemistry*.