Biomass Upgrading of Algae Polysaccharides into Furanic Platform Molecules

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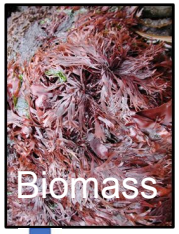
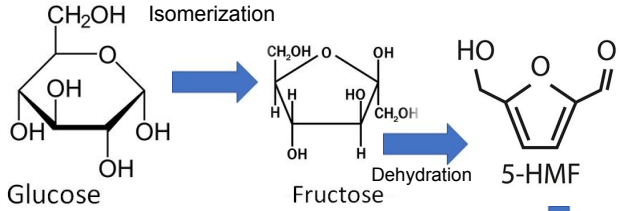


P. Mollis (Dulce) algae: grown in Dr. Rorrer's lab in Gleeson, frozen, then dried for 18 hours at 80 °C, is the biomass I will be using. Source of C6 carbohydrates.



Reaction pathway for conversion of glucose to HMF.

Side reactions start to produce humins and LA from HMF after about 1.5 hours, causing a decrease in percent yield.

This project studies the reaction conditions that maximize the percent yield of platform molecules from algae, including temperature, reaction time, and use of catalysts. My project studies the upgrading of algal biomass to 5-HMF and furfural, two platform molecules for the production of biomass derived fuels and chemicals. My stretch goal is to study the production of fuel and commodity molecules from these platform molecules, including oleofurans and 2,5-DMF.

Higher Level motivation:

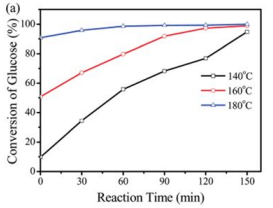
- Efficient and cost-effective fuel derived from algae biomass has the potential to replace fossil fuels and other less-sustainable biofuels as a renewable energy source.
- Ethanol derived from corn requires massive amount of land and energy, algae more energy efficient to produce

Special thanks to Dr. Konstantinos Goulas, Dr. Greg Rorrer, and Kyle Reem for their time and encouragement.

Methods:

- Time based reactions in small pressure tubes with heterogeneous catalyst, silica aluminum, and a homogeneous catalyst, HCl.
- Flame ionization detector used to determine percent yield of the value-added products.
- Using 1-octanol as the internal standard, ethyl acetate as the solvent
- Goal: Determine conditions to maximize percent yield of platform molecules

1.5 hours and 160 ℃ seem to give highest percent yield.



Source: *High yield production of HMF from carbohydrates over silica–alumina composite catalysts†*
Xiangcheng Li,a Qineng Xia,a Van Chuc Nguyen,b Kaihao Peng,a Xiaohui Liu,a
*Nadine Essayemb and Yanqin Wang*a (2016)*