Abstract of the Week: ABO Summit | Sustainable Waste-to-Bioproducts Engineering Center

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Utah’s hydraulic fracturing industry produces large quantities of wastewater, also known as produced water. This water contains high levels of contaminants such as salts and hydrocarbons, and variable concentration of nitrogen and phosphorus. Current technologies for dealing with this produced water are costly, with conventional methods including sub-surface injection and evaporation. Due to high cost, most produced water is treated as waste and dealt with accordingly. This project approaches this water as not waste but as a source of nutrients that can be used to grow and cultivate microalgae, which can be converted into a product stream.

Two strains of microalgae were grown in mixed culture using a Rotating Algal Biofilm Reactor (RABR), which was rotated in produced water taken from the Uinta Basin in southern Utah. The RABR was built at pilot scale to increase yield, and two substrata were used in construction, polystyrene and cotton rope. After testing was completed on motor power consumption, polystyrene in a disk configuration was chosen based on criteria that included low cost and high surface area to achieve the largest growth surface area to produced water volume ratio.

The microalgae strains that were cultivated were genetically characterized. One strain is a cyanobacteria that is present in the Logan Lagoons used for municipal wastewater treatment for the City of Logan, Utah. The other strain is present in the Great Salt Lake Utah. Harvested biofilm microalgae from the RABR were converted into biocrude using a hydrothermal liquefaction (HTL) reaction. The conversion of the biocrude gave a yield of 35% ash free dry weight and 58% of feedstock energy was recovered in the biocrude.