Executive **Summary**

WATER ENVIRONMENT & REUSE FOUNDATION

Practical considerations in producing biodiesel from wastewater grease

Extraction of Lipids from Wastewater to Produce Biofuels (U3R13)

The Central Issue

Grease trap waste and sewage scum grease, called wastewater greases, are underutilized, high-lipid wastestreams that have the potential to be converted into biodiesel, a renewable fuel. Biofuels produced from wastewater greases can be used onsite for process energy or sold into the transportation fuel market. The wastewater utility of the future is a water resource recovery facility. Understanding what resources, including grease and scum which are typically disposed of, can be recovered to produce renewable energy is important to furthering resource recovery as a model for the sector.

Context and Background

Fats, oils, and greases (FOGs) are separated from wastewater streams. When collected, wastewater greases are a mixture of water, solids, and FOGs that form a semi-solid, inhomogeneous mixture. Food service establishments install grease interceptors to remove FOG as a watery mixture called grease trap waste (GTW). FOGs that pass through the sewer system are collected in primary wastewater treatment as sewage scum grease (SSG). There are several technical challenges to efficient and economic production of high-quality biodiesel from GTW and SSG. An estimated 1.8 billion kg of FOG could be recovered from GTW (Ragauskas et al., 2013) which could produce about 500 million gallons of biodiesel per year. Much less is reported about available quantities of SSG. In addition, there are other degraded FOG feedstocks that could be converted to biofuels. The researchers examined the variability in waste grease composition, demonstrated the technical feasibility of producing biodiesel from these wastewater greases, and evaluated the environmental and cost tradeoffs using life cycle assessment and techno-economic analysis.

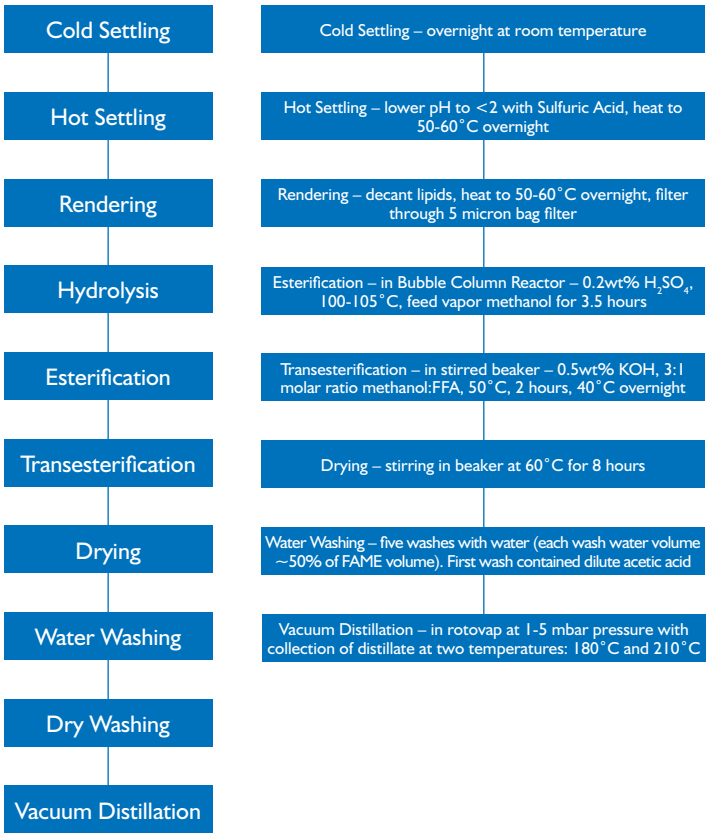
Findings and Conclusions

Biodiesel produced from these wastewater-derived greases meets all fuel specifications except for sulfur content. However, the average lipid content of SSG is seasonally dependent – lipid content ranges between 15-40% in cooler months and 3-21% in warmer months. The lipid content of GTW ranges between 1-25% with no apparent seasonal trend. The conversion of wastewater grease to biodiesel in cool weather is economically attractive, always producing a positive annual cash flow in the scenarios evaluated. However, this is not the case for scenarios in temperate climates during summer seasons or in warm climates. GTW can easily be partially dewatered by gravity separation to a lipid content of 11-100%. The lipids extracted from wastewater greases have high acidity, a high fraction of saturated fatty acids, and a high concentration of impurities.

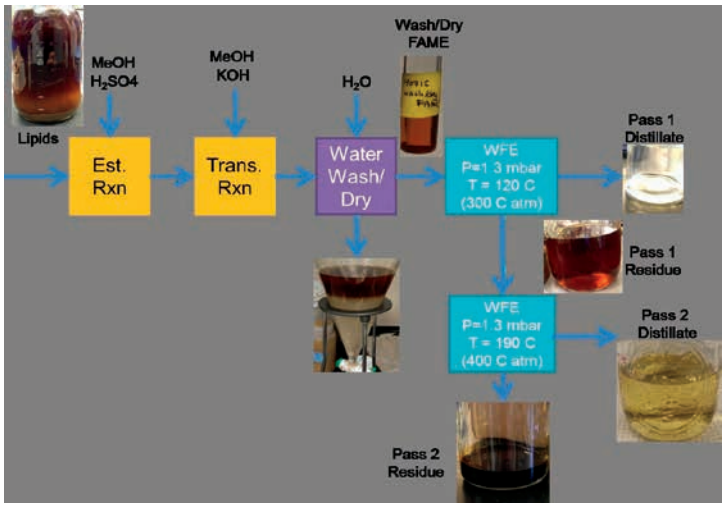
The techno-economic model used identified that obtaining grease from several locations is likely necessary for economic viability. However, there is not enough information available about GTW or SSG volumes produced to designate potential locations in most water utility service areas.

Management and Policy Implications

Separating lipids from wastewater greases, converting the lipids to biodiesel, and substituting biodiesel for low sulfur diesel produces a significant reduction in greenhouse gas emissions. However, there are challenges with the practical implementation of producing biodiesel from wastewater grease that include obtaining a sufficient quantity and reliable supply of grease and the ability to manage production given the variability of grease composition.



Sequence of Processing Steps and Typical Conditions Used for Processing SSG to Biodiesel.



Stages of the Conversion of SSG Lipids to Biodiesel Process.

Related WE&RF Research

Project Title	Research Focus
Fats, Roots, Oils, and Grease (F.R.O.G.) in Centralized and Decentralized Systems (03CTS16T)	Characterizes the chemical and physical makeup of fats, oil, and grease deposits in collection systems and examines grease interceptor design and contents.
Site Demonstration of the Life Cycle Assessment Manager for Renewable Energy – LCAMER (OWSO4R07f)	Provides examples of costs, environmental impacts, and other factors associated with utility decision making for energy recovery using combined heat and power practices.
Co-Digestion of Organic Waste Products with Wastewater Solids (OWSO5R07)	Provides a better understanding of the organic wastes that can be added to anaerobic digestion and the type of wastes (such as FOG) that have a synergistic effect on biogas production when added to biosolids during anaerobic digestion.
Barriers to Biogas Use for Renewable Energy (OWSO11C10)	Includes an evaluation of the social, business model, regulatory, technical, and other types of barriers to greater implementation of biogas energy or heat recovery by the wastewater industry and explores the potential use of biogas for vehicle fuel.
Genifuel Hydrothermal Processing Bench-Scale Technology Evaluation Project (LIFT6T14)	Demonstrates that biocrude can be generated from hydrothermal liquefaction processes using all three major types of wastewater sludge (primary, secondary, and digested solids) at reasonable yields (i.e., 25-37%) and of comparable quality to that of other biocrudes generated from other high water content biomass feeds.

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