Thesis Project Portfolio

Producing a Bioplastic from Biodiesel Waste: Polyhydroxybutyrate using Crude Glycerol

(Technical Report)

How the Evolution of the News Industry Encourages Petrochemical Company Misconduct

(STS Research Paper)

An Undergraduate Thesis

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Executive Summary

The petrochemical industry reaches almost every aspect of society. From soap, to plastic, to food additives, petrochemical products are in our daily lives for better or worse. These products make our lives easier and cleaner, but at the expense of greenhouse gasses, overflowing landfills, environmental pollutants, and safety concerns. The goal of this research portfolio is to address these issues. On the technical side, finding plausible alternatives to traditionally derived plastics is vital to reduce the carbon and waste footprint of the chemical industry. On the social side, it is important to understand the role local media has in protecting communities near chemical plants from environmental and health risks. Both of these topics highlight the inherent dangers of the chemical industry. However, the solution is not to get rid of the chemical industry altogether. Instead this portfolio poses solutions for ways that the industry and society can evolve to better coexist.

As plastic waste builds up in our landfills and oceans, it is vital to find a cleaner alternative to petroleum derived plastics (US EPA, 2017). A potential solution is biodegradable plastic made from biodiesel waste (Posada et al., 2011). Biodiesel is made by reacting vegetable fats with alcohol to form fuel that can be burned by diesel engines (*Alternative Fuels Data Center: Maps and Data - U.S. Biodiesel Production, Exports, and Consumption*, n.d.). The waste from this process, glycerol, can be fermented to form biodegradable plastic, polyhydroxybutyrate (PHB), for consumer or medical uses (Hejna et al., 2016). Designing an economically viable biodegradable plastic plant is vital for increasing the value of a waste stream as well as producing an environmentally friendly plastic, which is the goal of the technical report. Unfortunately, this project is not yet financially feasible due to high production costs and the low market value of PHB. In order for this project to be successful, more robust economic incentives

must be implemented by the government to encourage sustainable industry practices. Also advancements in the productivity of the bacteria used to PHB must be made to increase revenue.

Another environmental side effect of the petrochemical industry is the toxic waste that they produce. For people that live near a petrochemical facility, the negative environmental and health implications are more concentrated (Gelles & Steel, 2021). Communities located near petrochemical plants are disproportionately affected by emitted waste in the air and groundwater (Gelles & Steel, 2021). One last line of defense for local communities is their local news outlets. Local news is instrumental in whistleblowing corporate misconduct (Heese, 2021). However, as the news industry transitions to national news and social media local communities are more vulnerable to unchecked corporate misconduct (Abernathy, Penelope, 2018).

The goal of this research portfolio is to address the challenges of sustainability in the petrochemical industry from two sides. The technical capstone proposes a sustainable alternative to traditional petroleum derived plastics, making biodegradable plastic from biodiesel waste (Posada et al., 2011). The STS research paper addresses the impact of petrochemical plants on local communities, and how these communities could become more vulnerable to misconduct as the news industry evolves. The PHB plant design project will determine the economic and technical feasibility of an industry scale biological production facility in the United States which will be useful as the scale up of this technology is considered. The social analysis of the effect of the news industry on petrochemical company misconduct will raise awareness of the unforeseen consequences of the digitization and nationalization of news.

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