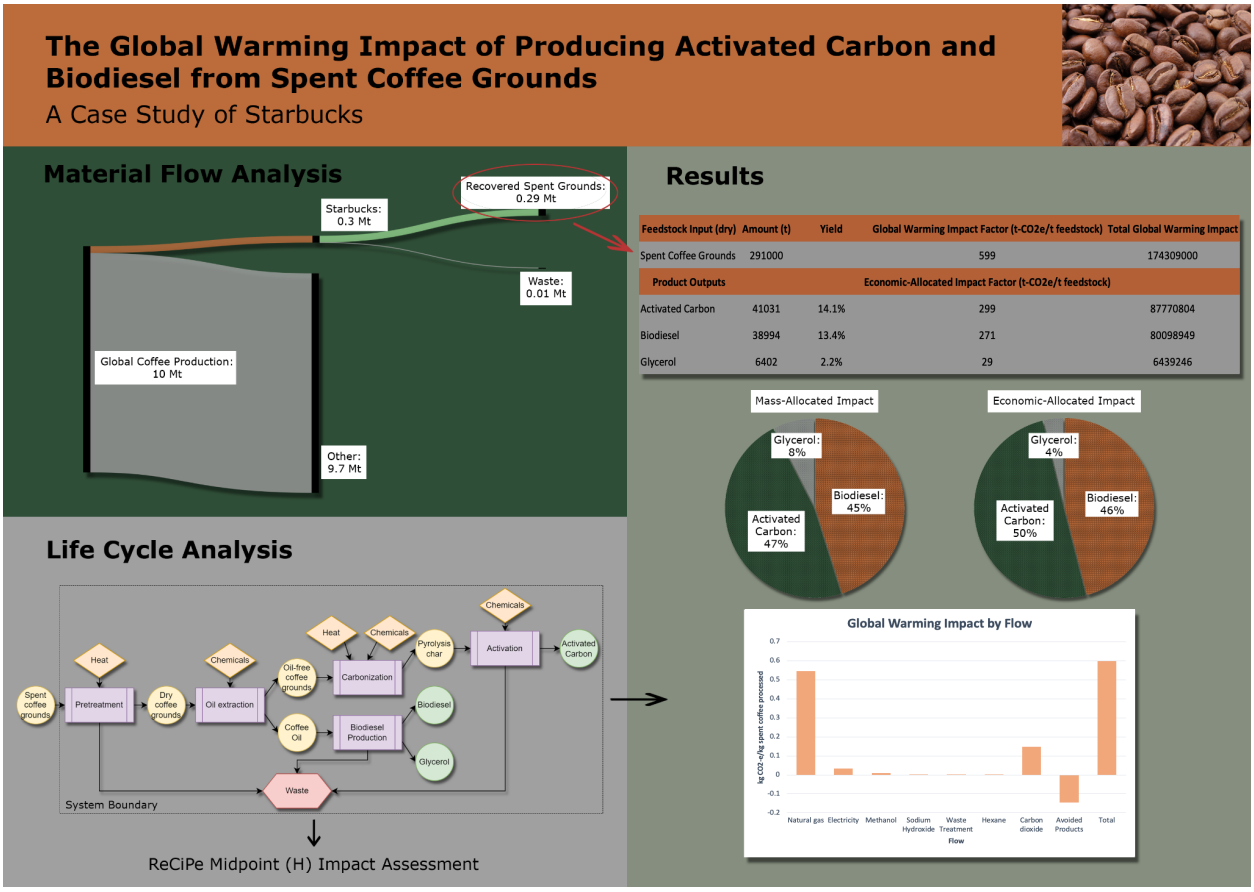
# The Global Warming Impact of Producing Activated Carbon and Biodiesel from Spent Coffee Grounds: A Case Study of Starbucks

Bradley Hills, Jackson Meng, & Yutong Li

## Abstract


Biogenic feedstocks are of interest as replacements for petroleum-based counterparts. However, the ‘food vs. fuel’ debate brings up several potential issues related to food security, land use change, and feedstock prices. The use of waste materials as feedstocks to improve material circularity may be a solution to this debate, as an agricultural product can be used for its initial food use and then the waste can be repurposed to produce other products, lessening the burden on agricultural systems. A potential candidate for this approach is spent coffee, as coffee is consumed in nearly every region of the world. To demonstrate this, this study has conducted a material flow analysis of Starbucks’ retail practice to illustrate how much spent coffee is potentially available, and the produced spent coffee is used to co-produce activated carbon and biodiesel. The results show that up to 291000 t of spent coffee is available as a feedstock from Starbucks’ retail practices. Life cycle analysis results indicate that the global warming impact of processing 1 kg of spent coffee grounds in the studied process is 0.599 kg-CO2e. The present study provides insight into the availability and climate change performance of spent coffee as a bioproducts feedstock, and serves as an example of the potential of waste products as feedstocks in place of food, helping answer some of the questions posed by the ‘food vs. fuel’ debate.


**Keywords:** Material flow analysis; life cycle analysis; circular economy; food vs. fuel; coffee