

Ecoverde Organics, LLC Seeks Evaluation of Biochar as a Method to Valorize Food Waste



Challenge

EVO was interested in food waste valorization methods other than composting.

Solution

EVO decided to investigate the potential for biochar production since this product has several markets with various applications (agricultural soil amendment and water filtration).

Results

The results demonstrated potential for water filtration or soil amendment applications, but further investigation is needed in the lab and on a larger scale.

The economic analysis illustrates the potential for this approach to be a profitable business venture.

Ecoverde Organics, LLC

Ecoverde Organics, LLC (EVO) is an organic waste recycling company located in Western NY. The company was founded in 2017. Currently, EVO produces organic composts from various organic sources, like manure and food waste, for gardens, landscapes, lawns, and organic crops. EVO was interested in investigating new valorization methods (creation of value-added materials) for organic waste to expand the business. The technique explored was the conversion of food waste into biochar—a material produced from pyrolysis of organic material that resembles charcoal with many potential uses in agriculture and filtration applications.

“The NYSP21 team was knowledgeable of business needs, worked effectively and communicated efficiently. The project results provided us with validation and direction for next steps, which is what we were seeking.”

EcoVerde Organics, LLC

Challenge

The NYS Food Donation and Food Scrap Recycling Law goes into effect on January 1, 2022. The new law requires businesses that generate at least two tons of food waste per week and within a 25-mile radius of an organics recycler to donate excess edible food and recycle any remaining food scraps. Since potential sources of organic waste are expected to increase, EVO is taking advantage of this opportunity to investigate other methods of food waste valorization. This project investigated the potential for the commercialization of biochar as an alternative method to composting.



Image: Discarded food scraps

Solutions

EVO requested assistance from the New York State Pollution Prevention Institute (NYSP2I) to investigate biochar production as a food waste valorization method. The biochar generated from food waste could be used as a soil amendment product or as a granulated activated carbon (GAC) replacement. Since food waste is typically heterogeneous, the potential applications of the resulting biochar may be limited. Therefore, besides mixed food waste, a more homogeneous waste (coffee grounds and chaff) was investigated for biochar feasibility studies. NYSP2I and the Civil, Structural and Environmental Engineering Dept. at SUNY Buffalo collaborated to perform a series of biochar tests to determine feasibility.

Results

The results indicate that the properties from biochar created from mixed food waste and coffee waste are amenable to both agricultural and other higher-value applications such as water filtration. Some of the critical results are below:

Coffee Waste:

- Production of stable biochar requires higher processing temperatures (500°C) but will result in a slightly lower yield.
- The heating rate does not significantly affect primary biochar properties.
- Production of biochar at 800°C may have the potential for agricultural applications due to near-neutral pH.
- Homogeneity of the waste stream is expected to result in higher-value biochar for use in filtration/adsorption applications.



Image: Spent coffee grounds

Mixed Food Waste:

- Samples showed high pH_{pzc} indicating the samples are elementary and could lead to potential use on acidic adsorbates.
- Preliminary methylene blue adsorption tests indicated that the biochar samples did not perform as well as the GAC (82-91% vs. 99% adsorption); however, this discrepancy is expected due to smaller pore volume and specific surface area.
- Results suggest there is potential use in course filtration applications.

First Order Economic Analysis:

- The available feedstock of mixed food waste within 50 miles of the proposed site is approximately 2900 tons of food waste per week.
- If 10% of the total feedstock is attainable, 37.5 metric tons of mixed food waste feedstock would be available daily.
- Approximately 2.2 metric tons of coffee waste are available per day.
- Incoming feedstock flow rate and produced biochar retail cost are the main factors that affect net profit. For an average 10t/day feedstock flow and biochar values of \$50, \$200, and \$500, the net profit ranges from \$70,000 to \$170,000 per year.

The results show that value-added biochar has the potential to be produced from coffee waste and mixed food waste. Lab-scale tests demonstrated that these feed streams yield biochar potential for agricultural and water filtration applications. Additional work is needed to validate the processes in the lab and on a larger scale.

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