

Closing the loop: Industrial Food and Agriculture Waste Valorization, the Case of Biosolarization

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Abstract

Global society faces a challenging task -- feeding a population of nine billion without irreversibly harming the environment. In order to overcome this hurdle, more sustainable agricultural practices are needed. To achieve sustainable agriculture, one needs to have measures that are both environmentally friendly and efficient. In our study, we developed a bioreactor system that can simulate the sustainable soil disinfestation process of biosolarization. Biosolarization uses the solar heat in conjunction with soil microbial community to treat the soil against weeds and pathogens. We were able to use the system to distinguish between major Californian agriculture and food industry waste streams including tomato paste and wine processing waste. Our findings suggest that tomato pomace (the residues of tomato processing food industry), grape pomace (residues of wine making industry) and fish meet waste (from canteens) can be used as a soil amendment for biosolarization. With the tomato pomace and grape pomace we observed soil temperature changes due to the microbial activity of over 2 °C across 4 days in a well aerated system. We also observed in tomato pomace acidification that changed the pH from 6.5 to 4.68 under anaerobic conditions. Such heat and acidification are sufficient to inactivate undesirable weeds and other pest when incorporating the tomato waste into the soil. White wine grape pomace amendment showed similar trends but to a lesser extent. Red wine grape pomace was generally less suitable for biosolarization due to significantly lower soil temperature elevations, reduced acidification relative to the other pomaces and induction of methanogenesis in the soil. The fish waste residues also shown to have a promising weeds inactivation results in a greenhouse studies. This novel system can help reduce high-cost field trials and can be use to examine a variety of potential soil amendments, such as straw and green waste and more. This can help create a beneficial cycle that utilizes food processing and agricultural waste biomass back into agricultural production of food and can play a

fundamental role in the future of food security.

Keywords: Biosolarization, food waste, next generation sequencing, sustainable agriculture, volatile fatty acids

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