Abstract

Discharge of liquid effluents from biogas facilities (also known as 'anaerobic digestate') is a serious environmental challenge recognized in Israel and around the world. Lack of an "end-of-life" solution to anaerobic digestate leads to uncontrolled dispersal in agricultural land, causing severe environmental pollution. Today, in Israel, there are about four biogas facilities that handle manure of about 25,000 dairy cows. An "end-of-life" solution to the digestate may significantly reduce the carbon footprint of biogas facilities and make them a significant alternative for the treatment of manure and dairy effluents. In order to develop an economically feasible solution to this problem, the current research program focuses on two alternatives: (1) maximum removal of nitrogen from anaerobic digestate; (2) maximum recovery of nitrogen from anaerobic digestate. During the beginning of the project, we recognize the high nutritional value (N,P,K) of the digestate and decided to focus on the second alternative (maximum resource recovery). In the first year, we focused on the characterization of the liquid phase of the anaerobic digestate, including chemical analyses s and phytotoxic activity. In a fertigation experiment, we grew coriander when the digestate (treated and untreated) to replace some of the required dose of nitrogen (given continuously as a liquid fertilizer). In the second year, we focused on the solid phase of the digestate and tested its value as a "base fertilizer" with corn (given one dose as a solid fertilizer). Along with monitoring plant growth and yield, we chose to quantify the potential for greenhouse gas emissions with an emphasis on N_2O - a greenhouse gas with a global warming potential that is 298 times higher than that of carbon dioxide. Aiming to enhance the sustainability of the system we also tested the feasibility to convert the solid pase of the digestate to hydrochar via a novel technology named hydrothermal carbonization and found the this feedstock can be used for this technology and the hydrochar may have high potential to be used as an additive to biological systems (e.g. anaerobic digestion). By the end of this project, we used the information to scale up and design a system that treat the livestock manure at Newe Ya'ar. To summarize, the research program offers a solution to the problem of the water from the load from biogas facilities - a problem that is very burdensome for breeders who want to treat the cavity and sewage effluent with this technology.