Bio-Energy Production from Anaerobic Digestion of Animal and Farm Wastes

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US produces annually huge amount of animal and farm wastes (e.g. only cow manure in amount of about 1.8 billion tons). These wastes can be valuable source of renewable energy besides overcoming the environmental problems caused by them such as greenhouse gas effect of methane emission of 22 times worse than carbon dioxide, surface and ground water contamination, odor, dust, ammonia leaching, etc.
In this project we systematically studied the process, kinetics, microorganisms interaction and population, and the effects of design and operating parameters on reactor design and scale up of cow manure digestion for bioenergy production and for wastes treatment by developing and implementing advanced imaging, visualization and computational techniques such as computational fluid dynamics (CFD), novel multiple radioactive particles tracking technique (MRPT), novel dual source computed tomography (DSCT), and microbiology imaging techniques. New design and conditions of anaerobic digesters that can reduce significantly the inactive volume and improve the digesters performance have been identified and recommended. In addition, for the first time, the energy produced has been related to the energy introduced in order to maximize the energy output while minimizing the energy input through the mixing power consumed. It is hoped that the findings will be applied in the field to promote bioenergy production and eliminate major environmental pollution problems.