

Review

Reviewing the Anaerobic Digestion of Food Waste: From Waste Generation and Anaerobic Process to Its Perspectives

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Abstract: Discharge of waste in general, and food waste, in particular, is considered one of the major environmental problems today, as waste generation increases continuously, reaching values of 32% of all food produced worldwide. There are many different options that can be applied to the management and evaluation of waste treatment, and Anaerobic Digestion seems to be one of the most suitable solutions because of its benefits, including renewable energy generation in form of biogas. Moreover, if FW (food waste) is digested in anaerobic digesters from Waste Water Treatment Plants, a common solution is provided for both residues. Furthermore, co-digestion of food waste and sewage sludge provides benefits in terms of anaerobic process stability enhancing the buffer capacity of ammonia (for example) and biogas formation, which can be increased up to 80% when compared with monodigestion. The present paper reviews food waste anaerobic digestion from its generation, characteristics and different options for its management, and it does focus specifically on the anaerobic digestion and co-digestion process, stages, limiting rates and parameters, utilizing numerous experiences, strictly related to food waste. Pre-treatments are also considered as they are important and innovative for enhancing biogas production and its methane yield. The paper shows an extensive collection of pre-treatments, its basics, improving factors, and numerical data of biogas formation improvements that are related both to substrate modification and to the synergistic effect of co-digestion, which could lead to an increase of methane production from 11% to 180%.

Keywords: food waste characterization; bioenergy; biogas; methane yield; hydrolysis; pre-treatments; perspectives

1. Introduction

Materials, intended or not, for human consumption that are discharged, lost, degraded, contaminated, or eliminated from the food supply chain (FSC), as well as the previous or forward stages and operations are known as food loss (FL) and food waste (FW) [1]. According to the Food and Agriculture Organisation of the United Nations (FAO) [2], FL is defined as any kind of change in the availability, or the quality of edible material that prevents it from being consumed by people. Due to this, food waste can be a consequence of FL.

Traditionally, FW was considered as the FL accrued at the retail and final consumption stages, so its generation is relegated to retailer and consumer behaviour [3]. Nowadays, the definition of FW also includes the losses incurred in the FSC stages or any other step of the agri-food industry, therefore it is defined as “any food and inedible parts of food, removed from (lost to or diverted form) the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea”.