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Enhancing energy recovery in form of biogas, from vegetable and fruit wholesale markets by-products and wastes, with pretreatments

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Abstract-

**Residues and by-products from vegetables and fruit wholesale markets are suitable for recovery in the form of energy through anaerobic digestion, allowing waste recovery and introducing them into the circular economy. This suitability is due to their composition, structural characteristics, and to the biogas generation process, which is stable and without inhibition. However, it has been observed that the proportion of methane and the level of degradation of the substrate is low. It is decided to study whether the effect of pretreatments on the substrate is beneficial. Freezing, ultrafreezing and lyophilization pretreatments are studied. A characterization of the substrates has been performed, the route of action of pretreatment determined, and the digestion process studied to calculate the generation of biogas, methane, hydrogen and the proportions among these. Also, a complete analysis of the process has been performed by processing the data with mathematical and statistical methods to obtain disintegration constants and levels of degradation. It has been observed that the three pretreatments have positive effects, when increasing the solubility of the substrate, increasing porosity, and improving the accessibility of microorganisms to the substrate. Generation of gases are greatly increased, reaching a methane enrichment of 59.751%. Freezing seems to be the best pretreatment, as it increases the biodegradation level, the speed of the process and the disintegration constant by 306%. **

Index Terms- waste recovery; sustainable recovery; food waste; fruit and vegetable waste; biomethane; anaerobic digestion; pretreatments

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