

**Topic:** Anaerobic Digestion of Food and Market Waste by Using Two-Phase Fixed Film Reactor

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### **ABSTRACT**

This study was conducted to improve the anaerobic digestion treatment of food waste and market waste in the control of inhibitory products, namely total volatile fatty acid (VFA) and undissociated acid. Rapid acid formed during start-up is a typical problem for heterogeneous market and food waste causing failure to the digester. The stepwise pH, dilution technique and neutral pH control as avoidance mechanisms of acid stuck were introduced to an acidogenic reactor in order to the depress undissociated fraction.

The results showed that the pH adjustment to neutral was more effective on VFA production than the leachate dilution due to its strong influence in controlling undissociated VFA inhibition. However, such condition induced an accumulated acid inhibition at low pH, stressing the methanogenesis onset of market waste under single-phase system, while an avoidance of acid formed by stepwise pH showed a long running time to achieve 60% of methane content. In turn, conventional single-phase condition with pH adjustment (neutral) showed the highest performance for treating food waste (10% total solid) both in terms of the waste degradation (74-78% VS reduction) and biogas conversion (63-84% CH<sub>4</sub>). Control of undissociated VFAs failed in a single-phase reactor treating market waste. Therefore, a conversion phase separation using a coupling acid reactor and a fixed film reactor was introduced. The coupling of an acidogenic digester to a methanogenic reactor showed a highly efficient performance in methane production (0.30-1CH<sub>4</sub>/gVS<sub>added</sub>) and gave an advantage to the acidogenic reactor, which can be used as a methanogenic source after a certain period. It was found that a two-stage process for food waste and market waste, with continuous suppression of inhibitory undissociated VFAs by pH adjustment, can achieve high efficiency for 40-52% gas conversion with the remaining organic solid carbon at around 7%.

**Keywords:** Anaerobic digestion, Food waste, Market waste, Two-phase reactor, Acid production, Undissociated acid