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Calorific and greenhouse gas emission in municipal solid waste treatment using biodrying

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ABSTRACT

BACKGROUND AND OBJECTIVES: Urban intensity and activities produce a large amount of biodegradable municipal solid waste. Therefore, biodrying processing was adopted to ensure the conversion into Refuse Derived Fuel and greenhouse gases..

METHODS: This study was performed at a greenhouse, using six biodrying reactors made from acrylic material, and equipped with digital temperature recording, blower, and flow meters. The variations in airflow (0, 2, 3, 4, 5, 6 L/min/kg) and the bulking agent (15%) were used to evaluate calorific value, degradation process and GHG emissions.

FINDINGS: The result showed significant effect of airflow variation on cellulose content and calorific value. Furthermore, the optimum value was 6 L/min/kg, producing a 10.05% decline in cellulose content, and a 38.17% increase in calorific value. Also, the water content reduced from 69% to 40%. The CH4 concentration between control and biodrying substantially varied at 2.65 ppm and 1.51 ppm respectively on day 0 and at peak temperature. Morever, the value of N2O in each control was about 534.69 ppb and 175.48 ppb, while the lowest level was recorded after biodrying with 2 L/min/kg airflow.

CONCLUSION: The calorific value of MSW after biodrying (refuse derived fuel) ranges from 4,713 – 6,265 cal/g. This is further classified in the low energy coal (brown coal) category, equivalent to <7,000 cal/g. Therefore, the process is proven to be a suitable alternative to achieve RDF production and low GHG emissions.

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