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Entitled

EXPERIMENTAL INVESTIGATIONS OF BIO-SYNGAS PRODUCTION USING MICROWAVE PYROLYSIS OF UAE'S PALM DATE SEEDS

by

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Abstract

From the start of the industrial revolution, the continued need for energy has been the most crucial issue in human history. An energy crisis started at the beginning of the 1970s when the number of machines, which became an essential part of our life, increased rapidly. Scientists made a huge effort to discover new sources of energy, with 'biomass' being one of the main focuses of researchers as a new renewable source of energy. In this thesis, a nonconventional method of heating, using microwave power in a pyrolysis process of biomass waste from palm trees (Allig's date seeds) for the production of bio-syngas to use in practical and industrial applications, is the main focus. Microwave heating has many advantages over conventional heating methods. In this method, the biomass heating occurs from the inside to the outside uniformly instead of heating the environment, as in the case of conventional heating. In designing the experimental work, a full factorial approach is utilized, using three parameter factors: particle sizes of (1790 µm, 783 µm, and 467 µm), microwave powers of (1,000 W, 700 W, and 300 W) and sample moisture contents of (0, 0.2, and 0.4). The yield of bio-syngas and temperature samples are monitored and measured throughout the tests using an "ETG MCA 100 Syn BIOGAS MULTIGAS ANALYZER" and an Omega Thermocouple respectively. In the last part of this work, a statistical analysis is conducted to nonlinearly model the gas yield average concentration percentages for CH4 and CO, as a function of all dependent parameters. The outcome of this study produces promising results, especially for CH4 and CO gas yields, which shows an average of 21 % and 15 % volume bases respectively. The yield of H2 gases is the lowest amongst all gas yields. The highest percentages of bio-syngas yield occurred at the highest microwave power, the smallest size of particles, and the driest samples. Allig date seeds as a biomass source in the microwave pyrolysis process demonstrate to be a promising source of renewable energy to be used in commercial and practical applications.

Keywords: Allig date seeds, microwave pyrolysis, bio-Syngas, cold gas efficiency, hot gas efficiency.