Determination of the combustion parameters of municipal solid waste samples and their blends with lignite with the help of Theromogravimetry (TG/DTG)

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Abstract

In Greece, there are annually produced more than 5.8 million tons of municipal solid wastes (MSW). The greater part (approximately 80%) of the latter are organic-rich (combustible) wastes and include paper, plastic, organic (biodegradable) and LWTR (leather, wood, textile, rubber). On the other hand, the share of the electricity production of Greece based on lignite burning is currently about 55%. However, the use of fossil fuels is considered highly polluting and releases greenhouse gases. Many countries in the world are considering co-firing of solid wastes and coal as an attractive option.

Several thermo-analytical techniques have been used for the study of solid fuels. Thermo-analytical methods may provide a rapid, cost-effective assessment of the fuel quality, delivering combustion characteristics, which could be essential for modelling the combustion in an industrial process.

This paper evaluates the thermal behavior of municipal solid wastes and their blends with lignite. Lignite and MSW samples were collected from the Western Macedonia region. For the production of the blends with lignite, both MSW and lignite samples were dried in an oven at 106 ^{o}C for 2 hours and mixtures of lignite and MSW were prepared in different proportions (30-50-70 wt%). Samples were analyzed by thermogravimetry (TG/DTG), using a LECO TGA701 apparatus. MSW samples and their blends with lignite (approximately 500 mg of each sample) were heated from room temperature (25 ^{o}C) up to 1000 ^{o}C, with a heating rump of 10 ^{o}C/min, under air atmosphere, with a flow rate of 3.5 l/min. Thermal parameters such as ignition temperature, maximum rate of weight loss, peak and burnout temperatures and burnout time were determined from the TG/DTG profiles of the samples.

TG/DTG methodology proved to be a useful tool for a first and elementary appraisal of the combustion behavior of the analyzed samples. The analytical results revealed that most of the blends are promising for energy recovery. Optimum combustion performance was found for all samples. Organic blends revealed low combustibility, which is attributed to the high content of inorganic matter and the heterogeneity of this type of wastes.