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SWIFT MODEL FOR LOWER HEATING VALUE PREDICTION BASED ON WET-BASIS PHYSICAL COMPONENTS OF MUNICIPAL SOLID WASTE IN TAIWAN ✓

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ABSTRACT

In this study 191 samples of the municipal solid waste (MSW) were gathered at 16 incinerators, located at northern, middle, and southern parts of Taiwan during 2002–2007. Analyses data for the chemical and chemical characteristics of these samples were used to create empirical prediction equations for lower heating value (LHV) of MSW on dry-basis and wet-basis physical component by multiple regression analysis. As a result, dry-basis model (DBM) and wet-basis model (WBM) correlation coefficients are 0.994 and 0.989, respectively. To verify the usability of the models, a demonstration program based on sampling of municipal solid waste incinerate (MSWI) at 4 incinerators located at the northern, middle, and southern parts of Taiwan was conducted. Consequently, the DBM showed a little superior precision in terms of relative percentage deviation (RPD) and mean absolute percentage error (MAPE), but WBM can be used to predict the LHV with much more convenience and less time than DBM. Furthermore, when compare these two empirical equations with some other equations presented in some textbooks of the solid waste management, the Mean MAPE of these two equations is better than those of the other equations. It was concluded that empirical models of DBM and WBM present in this study can afford a better predictability for the LHV prediction of MSW in Taiwan.

Keywords: MSW, lower heating value, multiple regression analysis, prediction equation

1. INTRODUCTION

Municipal solid waste (MSW) is one of the waste products generated from our daily life and various activities. It increases with the growth of personal income and population. In Taiwan, 4.73 million metric tons of municipal waste was generated in 2007 and this caused a severe disposal problem. To reduce the demand for landfill space, incinerators have been used to reduce the final disposal volume of MSW. According to the data of EPA, Taiwan, 24 MSW incinerators have been constructed by the year 2007. For designing and operating a mass-burn incinerator, the energy content of MSW is a very important control parameter. The energy content can be determined by using a full-scale boiler as a calorimeter, a laboratory bomb calorimeter, or calculation based on empirical models. Because of the difficulty of constructing a full-scale boiler, most of the data are obtained from the results of other methods. When compared to the measurements of a bomb calorimeter, the empirical model can determine the energy content of MSW more economically if the parameters in the model are well-established.