Spontaneous Combustion of Organic Materials by Water

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ABSTRACT

Recently, many fires and accidents resulting from spontaneous combustion of some organic materials, such as Refuse Derived Fuel (RDF), Meat Bone Meal (MBM), Wood Chips and so on occurred in Japan. In order to clarify the scenario of these fires and accidents, exothermic reaction of RDF and MBM with water at ambient temperature is characterized by the Clavet calorimeter (C 80 and MS 80) and the Thermal Activity Monitor (TAM). The tests for samples with different water content are conducted at near room temperature. The test results from the Clavet calorimeter and the TAM show existence of a weak exothermic reaction for both RDF and MBM with water in the temperature range from 25 °C to 60 °C while no heat generation is detected when no water is added in the samples. The exothermic kinetics is evaluated on the basis of the experimental information. Moreover, the standard UN Dewar vessel (H4) is used to simulate the process of temperature rise for stockpile of RDF and MBM. The results from the Dewar tests suggest significant temperature rise after water is added into the Dewar vessel for a period of time.

In addition, several different test methods, including the Thermogravimetry and Differential Thermal Analysis (TG-DTA), the Spontaneous Ignition Tester (SIT) and the Wire Mesh Cube (WMC) were used also. These tests reveal the exothermic characteristic at higher temperature although the weak exothermic reaction could not be detected by these traditional calorimeters at room temperature for both RDF and MBM with water. The test results of TG-DTA suggest that the exothermic temperatures are more than 140 °C and 180 °C for RDF and MBM respectively. The data of SIT give similar results, i.e. 140 °C for RDF and 185 °C for MBM. Several different sizes of wire mesh cube are used to get the critical temperature under the given size of wire mesh cube for both RDF and MBM.

Keywords: Spontaneous combustion; Organic materials; Clavet calorimeter; Thermal Activity Monitor;

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