Thesis Title	Heat Utilization Efficiency in a Fluidized Bed Sludge Incinerator
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Abstract

A fluidized-bed sludge incinerator, developed by the Environmental Technology Division was used for the study of the heat utilization efficiency. To utilize the waste heat, water tubes were installed inside the overbed area. The operating conditions of the incinerator were re-tested and the following conditions were found: the effective sludge combustion rate of 10-20 kg/h, the consumption rate of LPG was reduced from 4.35 to 2.40 kg/h, and the required combustion air flow rate had increased from 39.5 to 185.0 std. m^3/h. The water tubes were made of stainless steel (sch. 40) in a free board zone which had available heat transfer area of 0.97 m^2 with the maximum water flow rate of 2200 L/h. The sludge received from See Phraya waste water treatment plant. The study was carried out for both wet and dry sludge conditions. The results of combustion test show that the effective sludge feed rates are in a range of 10-15 kg/h and 5-7.5 kg/h for wet and dry sludge, respectively. The combustion efficiency of the fluidized bed incinerator was found between 93.9-99.8%. The heat utilization by the water was determined to be in a range of 22-37% of the total available heat, depending on the operating conditions. The overall heat transfer coefficients of the water tube were found to be 145-218 $W/m^2.K$. In addition, the combustion efficiency using the wet sludge was lower than the dry sludge, but its heat utilization capacity was generally higher. It is believed that the moisture content in the sludge fuel when heated to steam at higher temperature provided additional heat transfer input to the water inside the tubes. From the experiment, only the concentration of CO in the flue gas was detected to be higher than the standard allowable value. The concentration of CO measured to be in a range of 1131-1373 ppm. In the wet sludge combustion, the concentration of CO exceeded the emission standard by 30-58%.

Keywords: Fluidized-Bed / Sludge Incinerator / Heat Utilization Efficiency