Thesis Title	A Study of Statistical (DOE) Technic to Improve Combustion Efficiency of Boiler
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Abstract

This thesis studied the effects of four combustion parameters in boiler : oil temperature, oil pressure, damper and steam pressure. These parameters had effects on flue gas temperature, oxygen, carbondioxide, excess air and carbon monoxide. When treated, the efficiency of boiler could be envisaged from combustion and heat loss. Factorial Designs were employed as the research methodology to formulate Orthogonal polynomials equations of flue gas temperature, oxygen, carbon dioxide, excess air and carbon monoxide with the four parameters.

In this paper the four parameters were selected from the controlled ones that effects on combustion. Level of factors from daily check sheets were also considered and chose. The four parameters were as follow: oil temperature at 90, 100 and 110 degree; oil pressure at 0.45, 0.50 and 0.55 Kg/cm^2; damper at 1 and 2; and steam pressure at 1.5, 1.6 and 1.7 Kg/cm^2

Most of the experiment data resulted in the normal distribution : flue gas

temperature, carbon dioxide, oxygen and excess air. For carbon monoxide, the distribution was not normal, that is, for complete combustion carbon monoxide was zero; for the incomplete one the value was found from 1 PPM. to immeasurable and the nonlinear relationships was observer. LN was used to transform the incomplete combustion data to linear relationships before analysing the effects of those four parameters on carbon monoxide to formulate by equations. Then the incomplete combustion equation was converted back to nonlinear relationship.

From the experiment, the treatment of oil temperature at 100 degrees, oil pressure at 0.55 Kg/cm^2 and damper at 2 had an effect on high flue gas temperature and incomplete combustion. The oil temperature had the most effects. Oxygen and carbon dioxide had effects on four parameters with the treatment of oil temperature at 100 degrees, oil pressure at 0.55 Kg/cm^2, damper at 1 and steam pressure at 1.5 Kg/cm^2. This resulted in lowest oxygen and highest carbon dioxide that caused the worst incomplete combustion. The relationships between oxygen and carbon dioxide were inverse proportional, that is, when carbon monoxide increases, oxygen decreases. Excess air had effects on three parameters with the treatment of oil pressure at 0.45 Kg/cm^2, damper at 2 and steam pressure at 1.7 Kg/cm^2. This resulted in high excess air. Oil pressure at 0.55 Kg/cm^2, damper at 1 and steam pressure at 1.5 Kg/cm^2 had effects on low excess air. Carbon monoxide, with out transformation LN, resulted in a big minus values. With the application of LN, at the 0.05 level of significance, bester result wow found a low carbon monoxide level. The high carbon monoxide gave a poor result with the more complex model than the original one. Later the level of significance was increased to 0.01 to reach a higher reliability which lead to a less complexity in the model equations and gave low carbon monoxide value while at higher level showed less carbon monoxide and indicated incomplete combustion condition.

Keywords : Orthogonal Polynomials / DOE / Flue Gas Temperature / Oxygen / Carbon Dioxide/ Excess Air / Carbon Monoxide