Appendix 2

Abstract of Thesis

Report number	☑Ph.D. obtained through coursework and thesis No. 349 ☐Ph.D. obtained by research and thesis only No.	Name	AIZAM SHAHRONI BIN MOHD ARSHAD
Title of the thesis	Atomization and Combustion Characteristics of a Fuel–Water Rapid Internal Mixing Injector for Emulsified Fuel Combustion (エマルション燃焼用内部急速混合型油水噴霧ノズルの噴霧特性と燃焼特性)		

Abstract of theses

※ Please generate an abstract along the line of the composition of theses: Purpose / Problem presentation / Discussion / Conclusion.

In this study, a fuel–water rapid internal mixing injector capable of reducing emissions from combustion furnaces operating under high load conditions was developed. Employing this injector allows the injection of a fresh emulsified fuel mixture without requiring surfactants or additional processing equipment. The aim of the present study was to investigate the emulsification, atomization, and combustion characteristics of the injector when using soybean oil as a model high-viscosity fuel from a renewable source. Successful emulsification was observed in the mixing chamber over a wide range of water content ratios up to 0.5, under which a water-in-oil emulsion was discharged from the injector. As the water content ratio was increased, the Sauter mean diameter of the droplets in the spray increased. This is a result of the decrease in the mass flow ratio of atomizing gas to liquid and the increase in the viscosity of the fuel emulsion associated with the increase in the water content ratio which is influences the deterioration of the atomization. Although the emulsification of the base fuel resulted in the discharge of large droplets, the results showed that the nitrogen oxide and particulate matter emissions from a combustion furnace incorporating the injector were found to be reduced simultaneously following the introduction of water even under a high combustion load. The results obtained from combustion tests demonstrate the effectiveness of the injector for the simultaneous reduction of emissions while maintaining the stable operation of combustion furnace.

(Please print in double-sided printing if there are several pages.)