Abstract

The aim of this research is to study design parameters for wet scrubber to control particulate from rice mill boiler stack. The main objective was to figure out the collection efficiencies of wet scrubber when liquid to gas ratio (L/G) were varied. The optimum L/G were design according to the L/Gs those complied with criteria. The criteria were 1) 20% opacity standards for rice mill boiler stack (applied before February 4, 2007), 2) 10% opacity standards for rice mill boiler stack (applied after February 4, 2007) and also 3) particulate emission standard for rice mill boiler stack (320 mg/m³).

Relation between opacities and the concentrations of particulate from rice mill boiler stack was reviewed. A rice mill in central part of Thailand, using wet scrubber as particulate control system, was selected. During the study, water flowrates were adjusted and the opacities of the particulate form rice mill boiler stack were observed. Relative equations between L/G and opacity, L/G and efficiency were developed and tested for statistically confidence.

The study found that, for 20% opacity criteria, the minimum L/G was 0.086 I/m^3 . For 10% opacity criteria, the minimum L/G was 0.133 I/m^3 . If the particulate emission standard for rice mill boiler stack (320 mg/m³) was considered, the minimum L/G was 0.117 I/m^3 .

To apply this result for actual practice, each rice mill should know its exhaust air flowrate and then select the appropriate water flowrate from the table below.

Air Flowrate	Spray Water Required (I/s) Opacity	
(Actual)		
m ³ /s	20%	10%
4.0	0.34	0.53
4.5	0.39	0.60
5.0	0.43	0.66
5.5	0.47	0.73
6.0	0.52	0.80
6.5	0.56	0.86
7.0	0.60	0.93
7.5	0.64	1.00
8.0	0.69	1.06
8.5	0.73	1.13
9.0	0.77	1.20
9.5	0.82	1.26
10.0	0.86	1.33

To comply with the criteria, the suitable water drop sizes were 1,740 μ m and 1,638 μ m for the opacity of 20% and 10% respectively. Result also show that in wet scrubber, when the air velocity increases the water drop size decreases.

To compare the efficiencies from the study with theory, the values were compared with the efficiencies predicted by Johnstone and Calvert equations. Paired t-test with simple linear regression were applied. The result show that there was not significantly difference with 95% confidence between the measured values and the values predicted by Johnstone equation. But for the measured values and the values predicted by Calvert equation, there was significantly difference with 95% confidence.