STUDIES IN COLLECTION OF AIRBORNE PARTICULATES IN A ROTATING DISC WET DUST COLLECTOR

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CERTIFICATE

This is to certify that the thesis entitled "STUDIES IN COLLECTION OF AIRBORNE PARTICULATES IN A ROTATING DISC WET DUST COLLECTOR" being submitted by Mr. K. SAINATH to the Indian Institute of Technology, Delhi for the award of the degree of 'DOCTOR OF PHILOSOPHY' is a record of the bonafide research work carried out by him. Mr. K. SAINATH worked under our guidance for the submission of this thesis which to our knowledge has reached the requisite standard.

The thesis or any part thereof has not been submitted to any other University or Institution for the award of any degree or diploma.

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ABSTRACT

Particulate matter from industrial emissions in the atmosphere is known to have many adverse effects upon health and there is increasing importance to control the atmospheric pollution. One of the methods with great potential applicability involves contacting the particle laden gas with a liquid. Main advantage of wet collection system is possibility of removing particulate and gaseous pollutants simultaneously.

A survey of available literature on wet collection systems revealed that, with the exception of venturi scrubbers that the design of wet dust collector is mostly based on once experience and thumb rule rather than on a systematic design procedure. There is a great scarcity of published information on studies in pollution control devices.

Hence this work is taken for systematic study to design and develop a simple wet dust collector. The effect of design and operating variables on the collection efficiency of a rotating disc wet dust collector is studied. A dust concentration measurement instrument is also developed in the preser investigation.

Statistical design of experiments is used as a tool to study the rotating disc wet collector. Experiments were conducted as per Factorial design of experiments to determine qualitative effect of variables and Fractional factorial des

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Statistical design of experiments is used as a tool to study the rotating disc wet collector. Experiments were conducted as per Factorial design of experiments to determine qualitative effect of variables and Fractional factorial design

of experiments to determine quantitative effect of variables on the performance of the wet dust collector.

The rotating disc wet dust collector is designed with inertial impaction of dust particles as its basic collection mechanism. An experimental set-up consist of an vibratory solids feeder, a venturi disperser & a conveying pipe line to convey dust laden gases upto rotating disc wet dust collector.

A sampling train to measure dust concentration in gas inside a pipe line is designed, developed and fabricated to conduct study on rotating disc wet dust collector.

Experiments were conducted to study the qualitative effect of design and operating variables on rotating disc wet dust collector. The results indicated that jet velocity and jet diameter, have a significant effect on collection efficiency of the collector. But other variables, dust concentration, disc speed of revolution and distance between the jet and disc does not have a significant effect on the performance of rotating disc wet dust collector.

Quantitative effect of variables on the performance of wet dust collector is also studied. Collection efficiency is found to increase with increasing jet velocity and jet diameter. However variation in collection efficiency is found to be negligible with variables like dust concentration, disc speed of revolution and distance between jet and disc.

Effect of design and operating variables on pressure drop of the collector is studied. Jet velocity and jet diameter is found to have a significant effect on pressure drop of the collector. An empirical relation between pressure drop and collection efficiency of the rotating disc wet dust collector is developed. A comparison with other wet dust collectors is made using this empirical relation and the performance efficiency was quite comparable to high pressure drop wet collector such as venturi scrubber.

The basic models such as plug flow, lateral mixing and back-mixing models describing the collection process were tested empirically for rotating disc wet dust collector. The rotating disc wet dust collector is found to follow plug flow model for its collection mechanism.

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