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SUCHADA NARINSAKCHAI : MATHEMATICAL MODEL OF OPEN-AIR DUST REMOVING SYSTEM USING WATER SPRAYING. THESIS ADVISOR: ASS.PROF.TAWATCHAI CHARINPANITKUL, D.Eng., THESIS COADVISOR: PROF.WIWUT TANTAPANICHAKOON, Ph.D., 216 pp. ISBN 974-333-385-1

Water spraying is one practical method for dust removing in stone mining and crushing plants. So far there have been few investigations on the water spray system and the estimation of dust removing efficiency using water spray. Since this system is usually designed for operation in open air, the design calculation is quite complicated. Furthermore, the use of average sizes of water droplets and dust particles could lead to inaccurate estimate of dust removing efficiency. Therefore, the purpose of this work is to develop a mathematical model for calculating dust removing efficiency and investigating the effect of controlling factors, for instance, the size distribution of water droplets and dust particles and the ambient wind on the dust removing efficiency.

The result shows that this mathematical model is suitable for estimating the efficiency of the open-air dust removing system using water spray when the dust removal is dominated by inertial impaction mechanism. Additionally, this model can simulate various patterns of nozzle arrangement in order to select a suitable pattern with respect to the ambient wind direction. It is found that when the water droplet size and dust particle size are varied from 80-100 micrometer and 1-10 micrometer, respectively (ambient wind velocity in a range of 0-2 m/s), the collection efficiency rises as the dust particle size increases or the water droplet size decreases. The efficiency reaches a maximum when the water droplet size is about 100 micrometer.

Ambient wind increases the relative velocity between water droplet and dust particle and thus the dust removing efficiency. However, if the ambient wind velocity becomes too high, both water droplets and dust particles will be entrained with the wind. This results in a decrease of the dust removing efficiency. In conclusion, the important factors affecting dust removing efficiency are particle size distribution, followed by droplet size distribution and collecting height of spray. In contrast, particle concentration and ambient wind velocity have not much effect on efficiency.

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