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PA40) Experimental Study on the Performance of Cyclone with Granules in the Cone

R. B. Xiang, C. H. Jung[1)], D. S. Kim, and K. W. Lee

Department of Environmental Science and Engineering, Kwangju Institute of Science and Technology, [1)]Department of Environmental Engineering, Kyung-In Women's College, Korea

1. Introduction

Cyclone is one of the most widely used gas - solid separation devices in industries. In spite of its many advantages, lower separation efficiency and flat separation curve are usually associated with cyclones. Therefore, the primary goal of cyclone research is to improve its separation capability while retaining its basic features. In this study, granules were filled in the cone of a cyclone in an attempt to increase the cyclone separation efficiency through the combination of granular filtration and centrifugal separation.

2. Experiment

Separation efficiencies of cyclone with and without granules were measured at different flow rates. The measurement system consisted of an aerosol generator, aerosol conditioning part (drying and electrically neutralizing), a test cyclone with and without granules, and an aerosol detector. Test particles were monodisperse polystyrene latex (PSL) particles with diameter ranged from 1.5 m to 4.5 m. Granules filled in the cyclone bottom were glass beads of diameter of about 1mm. Pressure drop was measured using a Magnehelic gauge.

3. Results and discussions

Separation efficiencies for cyclone with and without granules in the cone were plotted in Figure 1 as a function of particle size at 15 L/min and 35 L/min. Data points in the figure were the averages of at least 5 replicate measurements for each case (with and without granules, flow rate, particle size). Error bar represents the standard deviation of repeated measurements. It is obvious that the granules increase the separation efficiency significantly at 15 L/min. In addition, it can be seen that without granules, the collection curve is very flat, but with granules, the collection curve becomes sharper. The increase in separation efficiency at this flow rate is probably due to the granular filtration mechanism. However, at 35 L/min, the influence of granules is opposite, which decreases the separation efficiencies of the cyclone. It has been observed that granules stayed still in the cyclone bottom at 15 L/min. Then at 35 L/min, some particles were blown upward to the upper body of the cyclone and kept swirling there. Therefore, the spiral flow in the upper body of the cyclone was unfavorably affected. This fact may account for the experimentally observed opposite influence of granules at 15 L/min and 35 L/min on cyclone performance.

In addition, pressure drop was found to be lower with granules than without granules at 35 L/min. It is generally accepted that the pressure drop is mainly caused by the swirling of the flow in a cyclone (Licht, 1988; Kang et al., 1989; Zhou and Soo, 1990). Therefore, lower pressure drop indicates that the swirling motion of the gas is suppressed, which results in the lower collection efficiency with granules at 35 L/min.

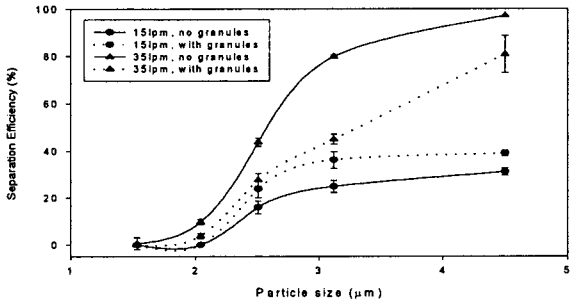

Fig. 1. Comparison of separation efficiency with and without granules.

Ackonwledgement

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