

Abstract

This research deals with the efficiency test of wetted screens for collecting dust from stone processing plants. It consists of the design and construction of the experimental apparatus and the investigation of the effects of operational factors on the collection efficiency, namely, inlet dust concentration, superficial velocity of air through the wetted screen, flow rate of irrigated water on the screen surface and type of screens (wire mesh and nylon screen). Furthermore, the effect of the ratio of cross-sectional area of the screen to the duct is also investigated in the cases of dry and wet screens, including the physical characteristics of the dust and the inlet dust loads ($C_i V_i t$).

Experimentally, the physical characteristics of the screens have significant effect on the dust collection efficiency, particularly in the case of dry screens. It is found that the dust collection efficiencies of the nylon screen with smaller aperture, chain weave and electrically non-conductive fibers are better than those of the wire mesh with larger aperture, square weave and metal fibers. In the case of superficial air velocity through the dry screens it is found that the collection efficiency increases with the air velocity, but decreases slightly in the case of wetted screens. The collection efficiencies of both screens increase remarkably with an increase in the flow rate of irrigated water, and approach together when the water flow rate further increases. In the case of inlet dust concentrations it is found that the collection efficiencies of both dry screens are essentially constant or decrease slightly as the inlet concentration increases. Evidently, the efficiency of the nylon screen is always better than that of the wire screen, though the efficiencies approach each other in the case of wetted screens. Furthermore, the collection efficiencies of both screens decrease slightly when the ratio of the cross-sectional areas decreases to 85% and decrease remarkably when the ratio is 70% of the cross section area of the air duct. In the case of inlet dust load ($C_i V_i t$) it is found that the collection efficiencies of both dry screens increase with dust load and the efficiency of the nylon screen is always better than that of the wire screen.