

Experimental Research of Smoke Impact on the Performance of Cylindrical Eight Channel Cyclone

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Abstract : Cyclones are widely used for separating particles from gas in energy production objects. Efficiency of normal centrifugal air cleaning devices ranges from 85 to 90%, but weakness of many cyclones is low collection efficiency of particles less than 10 μm in diameter. Many factors have impact on cyclone efficiency - humidity, temperature, gas (air) composition, airflow velocity and etc. Many scientists evaluated only effect of origin and size of PM on cyclone efficiency. Effect of gas (air) composition and temperature on cyclone efficiency still demands contributions. Complex experimental research on efficiency of cylindrical eight-channel system with adjustable half-rings for removing fine dispersive particles ($< 20 \mu\text{m}$) was carried out. The impact of gaseous smoke components on removal of wood ashes was analyzed. Gaseous components, present in the smoke mixture, with the dynamic viscosity lower than that of same temperature air, decrease the d50 value, simultaneously increasing the overall particulate matter removal efficiency in the cyclone, i.e. this effect is attributed to CO₂ and CO, while O₂ and NO have the opposite effect. Air temperature influences the d50 value, an increase in air temperature yields an increase in d50 value, i.e. the overall particulate matter removal efficiency declines, the reason for this being an increasing dynamic air viscosity. At 120 °C temperature the d50 value is approximately 11.8 % higher than at air temperature of 20 °C. With an increase in smoke (gas) temperature from 20 °C to 50 °C, the aerodynamic resistance in a 1-tier eight-channel cylindrical cyclone drops from 1605 to 1380 Pa, from 1660 to 1420 Pa in a 2-tier eight-channel cylindrical cyclone, from 1715 to 1450 Pa in a 3-tier eight-channel cylindrical cyclone. The reason for a decline in aerodynamic resistance is the declining gas density. The aim of the paper is to analyze the impact of gaseous smoke components on the eight-channel cyclone with tangential inlet.

Keywords : cyclone, adjustable half-rings, particulate matter, efficiency, gaseous compounds, smoke

Conference Title : ICEAFS 2014 : International Conference on Environment, Agriculture and Food Sciences

Conference Location : Lisbon, Portugal

Conference Dates : April 17-18, 2014