

Assessment of explosibility and explosion severity of rice flour at different concentration and ignition time

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ABSTRACT

This article presents a dust explosion characteristics of commercial rice flour at different concentration and ignition time. The rice flour with a moisture content of 7.79% (undried) and a mean diameter of $D_{50} = 28.77 \mu\text{m}$ was used in this work. The moisture in the rice flour was further reduced by oven drying to 2.47% (dried) and both samples were tested for comparison. Experiments were performed in a 20 L spherical explosion chamber to obtain the maximum explosion overpressure (P_{max}), rate of pressure rise (dP/dT), minimum explosibility concentration (MEC), and deflagration index (K_{st}) of undried and dried commercial rice flour. The dust samples and air mixtures were ignited by two chemical ignitors at the ignition time (t_v) of 60 and 100 ms. The propagation of pressure wave during the explosion process was measured by the piezoelectric pressure sensor. The P_{max} for undried and dried rice flour at t_v of 60 ms were found at 11.25 bar and 8.6 bar, respectively. The P_{max} was obtained at the highest concentration of dust (1000 kg/m^3). The highest pressure rise of undried sample was obtained at 81 bar/s whereas for dried sample the highest value was obtained at 98 bar/s. MEC of undried sample was found at 600 kg/m^3 and the dried sample at 500 kg/m^3 . The K_{st} of dried rice flour at ignition time 60 ms was found to be the highest at 26.6 bar m/s. It was found that the severity of the dust explosion increases proportionally with the dust concentration. Rice flour with higher moisture content has a lower explosion severity, than that of dried sample. Findings from this work provide a useful safety information about the severity and explosibility of rice flour, for which unsafe handling and operation may be minimized..

KEYWORDS

Deflagration index, dust explosion, maximum explosion overpressure, minimum explosion concentration, rice flour

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