Title: Effects of Concentration, Temperature, Humidity, and Nitrogen Inert Dilution on the Gasoline Vapor Explosion

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Highlights

- Experiments of gasoline vapor explosion under different conditions were taken.
- Influence of initial conditions on the explosion pressure was investigated.
- A formula was given to predict the maximum explosion pressure.

Abstract

This study aims at providing basic information for the explosion-protecting technology in the gasoline storage and transportation process. Experiments were conducted to investigate the explosion parameters under different gasoline vapor concentrations (0.92-2.40%), temperatures (283-343K), relative humidities (35-98%), and oxygen concentrations (12.66-20.32%) in a 20 L spherical vessel. Results show that both the maximum overpressure and the rate of pressure rise are quadratic functions of initial gasoline vapor concentration. At constant initial concentration, the maximum overpressure and the rate of pressure rise decrease linearly with the increase of temperature or humidity. When using nitrogen as the dilution, the maximum overpressure and rate of pressure rise respectively show a negative exponential and a linearly relationship with the oxygen concentration. The introduced nitrogen also narrowed the explosive limits. The fuel inertization point is 12.65 %. A nonlinear regression formula with 4 variables was obtained, which can be used to quantitatively predict the maximum overpressure at various initial conditions. These results are useful