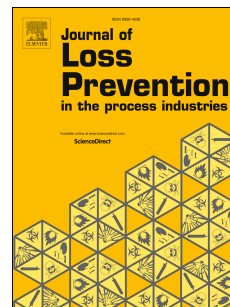


# Accepted Manuscript

Effect of size on methane-air mixture explosions and explosion suppression in spherical vessels connected with pipes

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# 1 Effect of size on methane-air mixture explosions and explosion suppression 2 in spherical vessels connected with pipes

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6  
7 **ABSTRACT:** An experimental apparatus was set up to demonstrate the effect of size on methane-air  
8 mixture explosions in spherical vessels connected with pipes. Two spherical vessels and pipes were  
9 used to constitute different-sized linked vessels. In this paper, gas explosions and explosion  
10 suppression were studied. Under the condition of the vessel size being changed and the pipe length  
11 not being changed, the maximum explosion pressure is almost constant, while the maximum  
12 explosion pressure rising rate decreases with increasing vessel diameter. A larger vessel with a longer  
13 pipe will lead to a safer explosion environment. When a large spherical vessel is connected, there  
14 exists a certain length to keep the pipe terminus safer. However, for a small spherical vessel, the pipe  
15 terminus becomes more dangerous with increasing pipe length. When wire-mesh is added between  
16 the pipe and spherical vessel, the maximum explosion rising rate in a small vessel decreases much  
17 more than without wire-mesh. However, for a large vessel, the change of the maximum explosion  
18 rising rate is not clear. Generally speaking, wire-mesh has a positive effect on explosion suppression  
19 in a vessel; however, in a pipe terminus, it has only a positive influence when a small spherical vessel  
20 is connected. The conclusions provide an important reference for the safety design of explosion  
21 venting and explosion resistance.

22 **Keywords:** Gas explosion; Explosion suppression; Size effect; Wire-mesh

## 23 1. Introduction

24 In the process industry, storage vessels and equipment filled with flammable and explosive gases  
25 are often connected using pipes. Once a flammable gas explodes in a vessel, the explosion flame and  
26 shock wave spread through the pipeline. This can cause fire and explosion accidents, resulting in great  
27 casualties and loss of property. However, the sizes of the vessels and the connection style of vessels  
28 and pipes are various in different technical processes, which can lead to different accident  
29 consequences (Wang et al, 2014; Yang et al, 2011). The explosion characteristics of gas or dust change  
30 with the vessel and pipe size, which is called the size effect of gas or dust explosions. The size also has  
31 an effect on explosion suppression (Zhang et al, 2014; Kristoffersen et al, 2004).

32 Some models and experiments (Bartknecht, 1981; Di Benedetto and Salzano, 2005, 2010; Larsen  
33 & Eckhoff, 2000; Nie et al, 2011, 2015; Phylaktou & Andrews, 1993; Zhang et al, 2014) have been  
34 presented in the literature, showing that the intensity of the pressure piling of interconnected vessels  
35 is affected by the pipe length and volume ratio. Bartknecht (1981) explored the effect of volume on

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