WCPT9

EXPLORING BEYOND LIMITS

WORLD CONGRESS ON PARTICLE TECHNOLOGY

September 18-22
MADRID 2022
wcpt9.org

ABSTRACTS' BOOK

Organized by

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ASOCIACIÓN NACIONAL DE QUÍMICOS E INGENIEROS QUÍMICOS DE ESPAÑA

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9th World Congress on Particle Technology (WCPT9) | ISBN 978-84-09-42782-6

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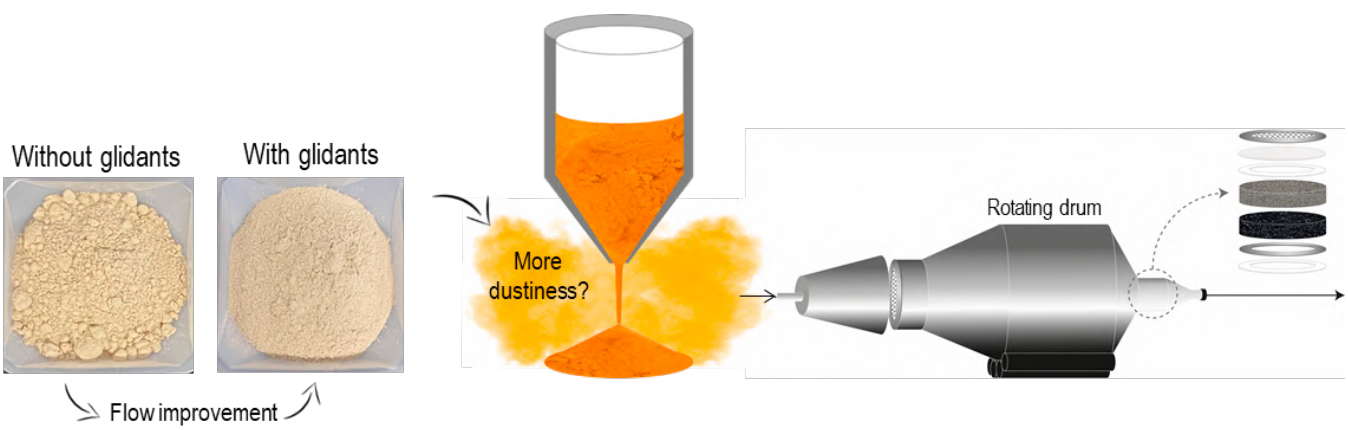
Keywords | Flowability, dustiness, glidants, colloidal silica

Powders are part of the design, production, and final products of different industrial sectors. Their handling, packing, and storage are subjects of interest because of the difficulties arising during manufacturing due to flow problems. Powder flowability can be improved by: facilities modification, which is a seldom universal solution; by the powder's fluidization, involving separation operations and increasing process complexity; and by the addition of nanoparticles, which is considered the more effective solution with the best benefit/cost ratio. Nowadays, nanomaterials are essential to the product conception of many industrial sectors, such as medical, cosmetic, food, and aerospace. Silica nanoparticles (S-NP) are widely used as excipients for different purposes. From a technological point of view, the addition of glidants in powders has been based on practical experience, trial, and error, leading to about 0.5 to 2% wt. of S-NP. From a safety point of view, the regulation entities consider S-NP as non-toxic and nonirritant, and the FDA[1] and the EFSA[2] approve S-NP as a food additive.

Notwithstanding, their toxicity has been a persistent concern over the years. Several in vitro studies show that S-NP are toxic in different types of human and animal cell lines. The effects of nanoparticles on individuals and the environment have not yet been thoroughly evaluated, and this will only be successful with a worldwide scientific and legislative effort.

Our project aims to determine the relationship between two end-use properties of powders, their ability to flow, enhanced by the use of glidants, and dustiness. Here, we use four flow additives to improve the flowability of four industrial powders (microcrystalline cellulose, wheat flour, joint filler, and glass beads) and evaluated dustiness using a rotating drum and a vortex shaker. Our findings suggest that adding glidants to improve flow behavior increases the sample's dustiness, composed of colloidal S-NP suspensions.

[1] US Food and drug administration
[2] European food safety authority



Inertization of ignition in biomass dust layers

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Keywords | Inertization, dust layers, safety biomass flammability

The use of biomass has heavily increased in the past years, and so has the number of accidents related to its storage, transport, and use. In this context, it is important to define the flammability and explosion characteristics in order to have a proper knowledge of material's behaviour and prevent accidents (Eckhoff 2003). The present work aims to study ignition inertization in biomass dust layers. To do so, wood pellets were milled and sieved obtaining a < 1 mm particle size sample. The sample's flammability characteristics were defined trough minimum ignition temperature of dust layer and cloud (MIT-l and MIT-c) and minimum ignition energy (MIE). Moreover, the characterization was completed using thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) so moisture, volatile content, maximum

weight loss temperature, etc., were defined.

Furthermore, the present study focuses on a possible solution to biomass flammability tendency by adding solid inert material (Danzi, Marmo, and Riccio 2015; Janés and Carson 2013). In particular, two different inert materials were used (sodium bicarbonate and recycled glass) and mixed with biomass at different concentrations (30%, 50% and 70%). Once the mixed samples were produced, minimum ignition temperature of layer (MIT-l) was defined for each sample, so the inerting effect was clearly noticed. Additionally, the samples (both raw and mixed with inerts) were tested using TGA and DSC techniques in order to analyze their thermal behaviour, thus allowing the definition of a threshold that indicates the optimal inert concentration that significantly increases MIT-l while the heating value is not substantially reduced.

References

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Analysis and reduction of the risk of fire explosion in pyrotechnic stores

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Keywords | Safety, fire explosion, pyrotechnic, flammability risk

A fire inside a pyrotechnics magazine can cause the simultaneous initiation of the stored articles, with the wave of shock that is produced promoted by the pressure of the gases generated in its interior. The purpose of this research is to analyse the phenomena that develop as a result of a fire inside the pyrotechnics stores and establish possible effective prevention and protection measures to reduce the risk of explosion.

An analysis of the risk of explosion and fire consequences in a pyrotechnic magazine, testing to real scale, was initially carried out. The measurements of Reflected Pressure recorded in the tests are consistent with the predictions of the mathematical model in the TM 5-130 manual for black powder (Department of the Army, Department of the Navy, and Department of the Air Force 1990). Limiting the maximum permissible load, considering the volume of the store, would reduce the seriousness of the consequences in the event of an accident. However, the maximum permissible levels should be so low as to make their use for retail sale of pyrotechnic products unviable.

Therefore, and in order to reduce this risk of explosion, it is necessary to minimize the possibility of a fire inside a pyrotechnic magazine. Different systems of detection and automatic extinction of fires in pyrotechnic magazines were evaluated, testing to real scale. Once a fire has started inside a pyrotechnic product packaging, it is very difficult to achieve its extinction, so it is necessary to try to prevent it from spreading to nearby packaging by a rapid detection (using a smoke detector, optical, ionic and/or suction) associated with automatic extinguishing and an extinguishers agent with a high cooling capacity which prevents the spread of the fire (water or foam).

The results obtained have allowed the Ministry of Industry, Energy and Tourism, update the current regulation (Complementary Technical Instruction 17 of the Regulation of Pyrotechnic Articles and Ammunition, approved by the Royal Decree 563/2010, of May 7).

FLASH COMMUNICATIONS

Numerical analysis of granular dynamics in a full-scale continuous blender using DEM

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