

**DEVELOPMENT OF A MODEL TO MINIMIZE DUST
EXPLOSION IMPACTS IN PHARMACEUTICAL
INDUSTRY**

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DECLARATION

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Further, I acknowledge the intellectual contribution of my research supervisor Dr. (Mrs.) Yasangika Sandanayaka for the successful completion of this research dissertation. I confirm that I will not make any publication from this research without the names of my research supervisor as contributing authors, unless otherwise I have obtained written consent from my research supervisors.

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**DEVELOPMENT OF A MODEL TO MINIMIZE DUST EXPLOSION
IMPACTS
IN PHARMACEUTICAL INDUSTRY**

Dust explosion is a major industrial disaster which result catastrophic outcomes if not controlled with necessary enforcements. Various industries which handled powdered materials are associated with dust explosion risk. Food, Tobacco, Plastics, Wood, Paper and pulp, Rubber, Pesticides, and Pharmaceutical are some of the industries associated with dust explosion risk. All the powder types does not responsible for dust explosions though particle size, dimension of particles, moisture content, upper and lower ignition limits, powder resistivity and charge relaxation time of combustible powders has a direct correlation with dust explosions. Dust explosions, initiated with the formation of dust explosion pentagon, which comprises with Combustible dust, Oxidant, Ignition source, Dust cloud and Confinement of dust.

However, the comprehensive literature review reveals that there is lack of studies on dust explosion scenarios, it's impacts, in-depth investigations in to causes and strategies to minimize the impacts of dust explosions in pharmaceutical industry. Therefore, the aim of this research is to develop a model to minimize the dust explosions and its subsequent impacts in pharmaceutical industry. The research objectives were achieved through mixed research approach by using semi structured interviews with experts in pharmaceutical industry and through the direct observations made during the site visit of pharmaceutical plant visits. The data collected during the structured interviews and site visits were collated in to tabulated and graphical mode to create a comparative analysis of three pharmaceutical manufacturing plants belongs to same mother company in three different countries. The findings of the research revealed the risk profiles of three pharmaceutical plants were differentiated with the combustible nature of the powdered raw materials used for each products in plant, quantity of those materials stored at plant and the risk associated with each activity or unit operation. Combustible nature depends on the minimum ignition energy of the material, and quantity of materials stored at plant depends on the batch size, chemical quantity of that particular chemical used for a batch. Finally the risk related to activity depends on the frequency of operation, no of peoples involve for the activity and the nature of the activity and the powder type.

Causes of dust explosions were analysed using the investigations done for dust explosion incidents happened at three pharmaceutical manufacturing plants. Causes identified were categorized in to three causes types immediate, underline and root causes. The root causes which need to be eliminated to prevent the dust explosions were identified as inadequate risk assessments, inadequate housekeeping inadequate training and deficiencies in change management. Failure to eliminate these root causes will effect health and safety, environmental and business impacts which could directly affect to the continuation of business. Impacts of dust explosions in pharmaceutical industries can be controlled through disaster cycle approach which includes prevention, preparedness, response and recovery strategies. A single model which discuss the causes and impacts of dust explosions and the strategies to minimize the impacts of dust explosion using disaster cycle was developed to be used in pharmaceutical industries.



*To my Beloved Father
for spending his entire life for position me to
this level today
and Dr. C.W.W Kannangara for introducing
free education for this country,*



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