

Conceptual Design of Road Side Adhesive Dust Collector

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Abstract: *The air pollution control all over the world is less efficient and it requires additional innovations. The air pollution leads to several health issues and it can impact the daily lives. This paper focusses the novel method of reducing pollution in the road side. The rectangular shell type block filled with adhesives has a pore in one side of the block. The adhesive block inside the block come out and held static with equal pressure maintained by a control valve. The adhesive has held static interacting with the air medium and collect the dust. The collected dust forms a rectangular block structure and drop it in the dust collector due to gravity. The conceptual design shows how the dust is collected by using static adhesive medium.*

Keywords: air pollution control, health impact of pollution, novel pollution reduction, adhesive dust collector, conceptual dust collection design

1. Introduction

The population control requires further investigations because of the population and economic growth all around the world, leads to increases pollution around the globe. The pollution affects the environment and its leads to affecting the life of the living around the polluted area. The government put efforts to control the pollution but it requires more innovation and development of technologies. According to the author's analysis, there is a spectrum of dust particles on the road that might cause cancer and other illnesses due to human movement, tire wear, and brake wear. [1].

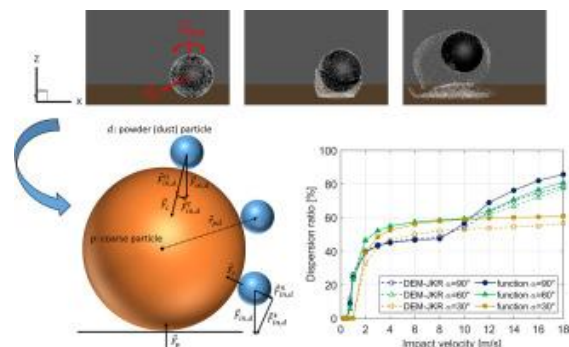
In order to lessen the possibility of dust and air stream pollutants spreading throughout the air in the working areas, the authors recommend reducing industrial emissions by installing cutting - edge air purification systems on the discharge pipes from dusty road producing equipment. [2]. This demonstrated that, among other factors, the positioning of the heliostat will influence dust deposition. Based on particle size and position, the study given demonstrates the necessary free - stream air velocity for cleaning such a mirror [3]. The capacity to capture dust was enhanced by the high wetting spray. While the overall dusting rate was over 90% and the respirable dust dusting rate was over 84%, the efficiency of dust removal might be improved by around 10% [4]. In order to clean the air in a city highway with a wide range of dust and exhaust gas flows, the article explains the design of the equipment (reactor) used to disperse particles and decontaminate the toxic components of exhaust gas. It also explains how this equipment differs from the facilities that are currently in place. [5].

2. Materials and Methods

Principles Used

The principle behind the adhesive dust particle attached in the rectangular box like structure is based on Adhesive Finite

Discrete Method to describe the carrier and dust particle motion.



Furthermore, in a non - adhesive DEM, where only the coarse carrier particles are tracked as a single composite bulk particle, dust detachment functions are accomplished. Three criteria are included in the implemented detachment functions: a rotating condition, a normal lift - off condition, and a tangential lift - off condition. Dust - resolved adhesive DEM simulations are used to benchmark these functions by altering important parameters during particle - particle and particle - wall interactions. Experimental single drop experiments are used to calibrate the adhesive force beforehand. Assuming dust particles with a restricted size distribution, the detachment criteria accurately represent the physical separation of individual dust particles. Therefore, using the improved dust detachment algorithms makes it possible to forecast the release of individual dust particles with a lot less computation time.

Methodology

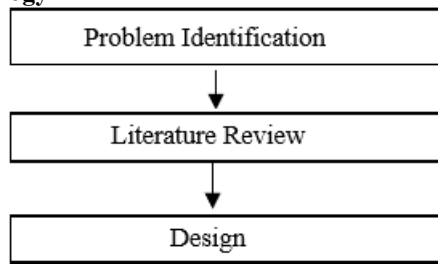


Figure 3.1: Methodology

Overview of Methodology

Problem Identification

The road side dust coming out from the vehicle movement and tire and brake wear makes health issues of the side walkers and a person who works in the street.

According to the stats 8 in 105 people who affected by lung cancer as of 2025. In recent years number of nonsmokers affects by lung cancers increases. The main reason of the increase of the lung cancers is unknown. People estimated that air pollution is the main cause of this. Reducing the pollution in the atmosphere is the challenge of that now.

3. Literature Review

The literature review focusses on the previous method of collecting the pollution in the atmosphere. The previous papers discuss the impact of dust in the road created in major cities and how its controlled.

The methods used in previous paper focusses on effective dust collection in the roads and the side walk aways.

4. Design

In the design collection of dust in the road side is possible by adhesive dust collecting panel. The rectangular box like structure has a pore in one side of the box. This adhesive medium is controlled by constant pressure that makes the fluid came out and held static in the surface of the box structure.

When the air medium is interacted with the fluid medium that's collects the dust that spread in the atmosphere. The collected dust increases and forms a rectangular dust section and it sides into the dust collecting space. The collection carrier collects the rectangular dust section.

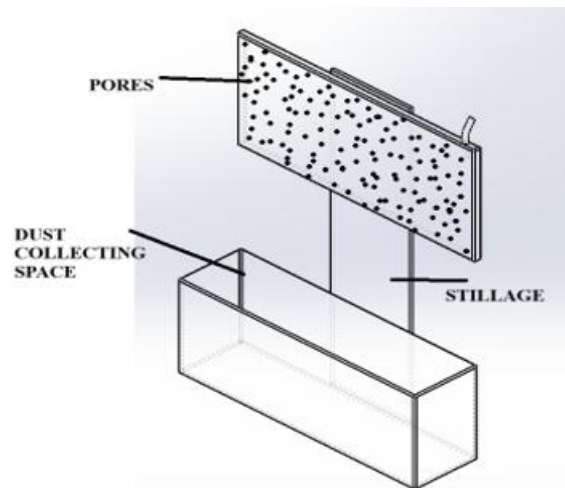


Figure 3.1: Assembly of the conceptual design

Figure 3.1 shows the conceptual design of the dust collecting system.

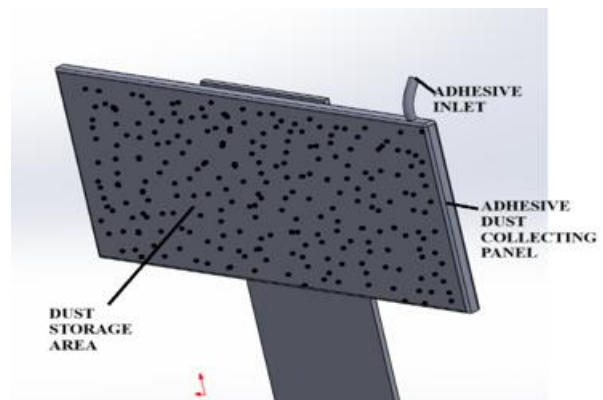


Figure 3.2: Modified dry medium 3D fluid flow path

Figure 3.2 shows the dust collecting panel and the storage area where the dust is stored by static pressure given to the adhesives.

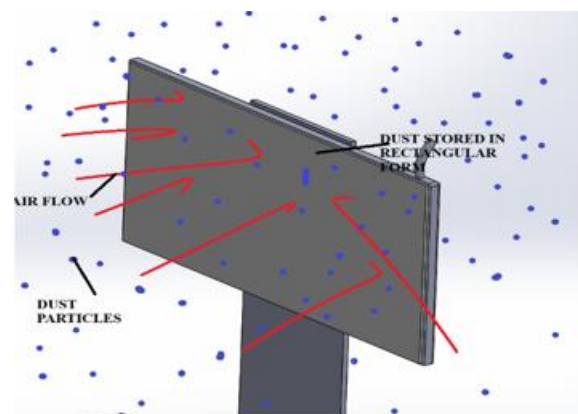


Figure 3.3: Air flow and dust particle collection

In the figure 3.3 dust collected in the panel due to adhesive medium is shown. The collected dust slides due to the less friction and the own weight of the dust particle. The dust is collected by dust collecting space and its replaced.

5. Conclusion and Future Scope

This study developed a conceptual design of adhesive dust collector. The goals of the design to develop innovative solution to reduce dust in the road side.

The dust is collected by adhesive medium is novel and the further modification and analysis makes the design capable of commercialization.

The environment is affected by excessive carbon emissions that is the problem that's makes the climate change, global warming and other environmental issues. The further analyses of this paper may find a way to collect the carbon content in the atmosphere by adhesive collector and store the carbon and recycled it.

References

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