IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 1, May 2024

Design and Fabrication of Atmospheric Dust Collector for Stone Crushers and Crematorium Units

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Abstract: *This project aims at developing a machine for reducing the dust from stone crushers and crematorium unis. Most of the manufacturing industry faces significant challenges in the control of dust to ensure continued sustainable operation and to meet emissions regulations and goals. The methods for controlling dust emissions can either lie in the prevention of dust emissions or in the removal of dust once it has become airborne. Though the concept for dust collection system seems simple, many things can go wrong if don't pay careful attention to the design details. Dust control systems involve multiple engineering decisions, including the efficient use of available space, the length of duct runs, the ease of returning collected dust to the process, the necessary electrical requirements, and the selection of optimal filter and control equipment. Further, key decisions must be made about whether a centralized or multiple system are best for the circumstances. Critical engineering decisions involve defining the problem, selecting the best equipment for each job and designing the best dust collection system for the needs of an operation. Well-designed dust collection systems need to consider not only the dust as a potential contaminant, but also the attributes of the dust capturing system. There are four key components in a dust collection system is very important like dust collector body, dust collector and the air mover/fan. This project helps to understand as a design guide which provides information that will help to achieve optimum performance and energy efficiency in commercial dust collection systems by properly selecting and sizing of dust collector and air blower or fan. A well-designed dust collection system has multiple benefits resulting in a dust-free environment that increases productivity, comply with emission regulations, and improve industry employee morale.*

Keywords: stone crushers

I. INTRODUCTION

A dust collector is a system used to enhance the quality of air released from industrial and commercial processes by collecting dust and other impurities from air or gas. Designed to handle high-volume dust loads, a dust collector system consists of a blower, dust filter, a filter-cleaning system, and a dust receptacle or dust removal system. It is distinguished from air purifiers, which use disposable filters to remove dust.

Our project focuses on designing a dust collector to mitigate the release of stone dust from crushers. It utilizes an AC 240V fan with a flow velocity of 11m/s to draw air from the work environment into a collector frame. The frame, constructed from 0.75- inch plywood in a rectangular shape, provides structural strength. Within the frame, parallel filters are installed to capture dust particles. These filters are capable of filtering particles within the range of 5-100 microns, ensuring that the air passing through them is clean and free from contaminants.

II. METHODOLOGY

The dust collector designed to reduce the stone dust from the crushers by using a AC 240V fan with a flow velocity of 11m/s which pulls the air from the work environment to the collector frame. The frame made of .75 inch ply wood to ensure strength by rectangle figure and it consists of filter in parallel and the air from the fans are guided to flow through the filters. The filter has a capacity to filter the particles between the range 5-100 micron to ensure the air is clean .

DOI: 10.48175/IJARSCT-18085

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The project aims to make the clean work environment in an economical way that it can be used for small range crushers

III. LITRATURE REVIEW

S. No:	Name of the Author	Title	outcome
1.	S. Ravindran, Dept. of Mech. Engg., Bharath Inst. of Sci. and Tech., Bharat University, Selaiyur, Chennai - 600 073, India	Stone Crushers and Dust Problem.	• Open call for the development of a dust extraction system to Indian environmental conditions. • The proposed system should be economical and capable of in-situ performance testing.
2.	Mr. A. C. Dubal , Assistant Professor SYMBIOSIS SKILL & OPEN UNIVERSITY PUNE.PhD Scholar M.E.Civil (Structure),M.B.A,LMISTE	The Utilization Of Crushed Stone Dust As A Replacement Of Sand In Cement Concrete	• Explores the potential of replacing sand with stone dust in concrete mixes. • It emphasizes the importance of understanding the impact of fine aggregate on strength and workability before replacement. • The study suggests that stone dust can fully replace sand with appropriate mix adjustments.
3.	Dr. Qiang (Chong) Zhang, P.Eng, Professor University of Manitoba	Design analysis of Dust collection system	• The importance of effective dust control in manufacturing industries to meet emissions regulations and sustain operations. • It discusses the complexities of designing dust collection systems, highlighting key engineering decisions and components involved. • It concludes by stressing the need to consider customization and upgrades within an overall air quality control strategy.
4.	Central Pollution Control Board Ministry of Environment, Forest and Climate Change Parivesh Bhawan	Environmental Guidelines for Stone Crushing Units	• The catch in this article lies in the detailed environmental guidelines provided for stone crushing units to mitigate fugitive dust emissions. • While the guidelines outline numerous measures to control pollution, including water sprinkling, enclosure of crushers, installation of dust extraction systems, and proper covering of conveyor belts, the effectiveness of implementation depends heavily on compliance and enforcement by regulatory authorities.

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IV. MATERIAL SELECTION

Material selection is a step in the process of designing any physical object. In the context of product design, the main goal of material selection is to minimize cost while meeting product performance goals. Systematic selection of the best material for a given application begins with properties and costs of candidate materials.

DUST COLLECTOR BODY

Material Used- Ply wood

One of the primary advantages of plywood is its exceptional strength and durability. Plywood is engineered by bonding multiple layers of wood veneers together, which creates a sturdy and resilient material. This structural integrity enables plywood to withstand heavy loads, impacts, and changes in temperature and humidity. It is an ideal choice for furniture, flooring, and structural applications where strength and longevity are crucial.

Fan selected – axial fan

An axial fan is a type of fan that causes gas to flow through it in an axial direction, parallel to the shaft about which the blades rotate. The flow is axial at entry and exit. The fan is designed to produce a pressure difference, and hence force, to cause a flow through the fan. Factors which determine the performance of the fan include the number and shape of the blades. Fans have many applications including in wind tunnels and cooling towers.

Filter selection

Filter selected – Cabin air filter

The cabin air filter acts as a shield between you and the outside world, preventing dust, pollen, smog and other harmful particles from entering your vehicle's interior. This helps ensure a healthier and more comfortable environment for you and your passengers.

CAD MODEL OF DUST COLLECTOR

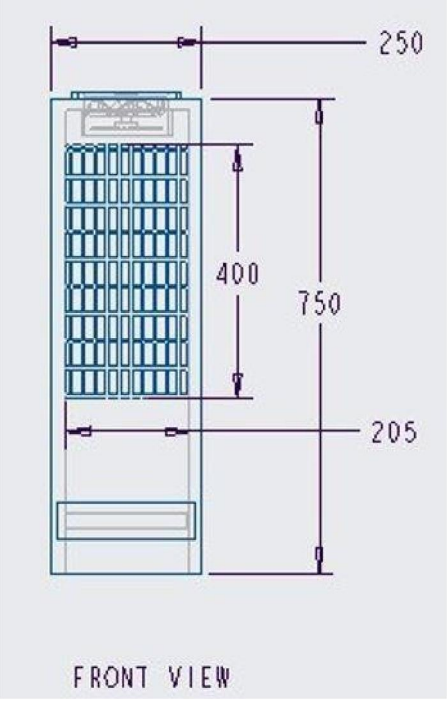

Fig 4.1 Front View

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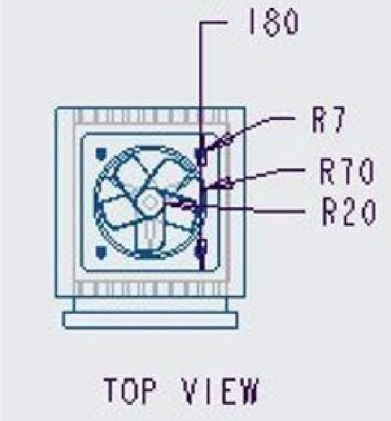

Fig 4.2 Top view

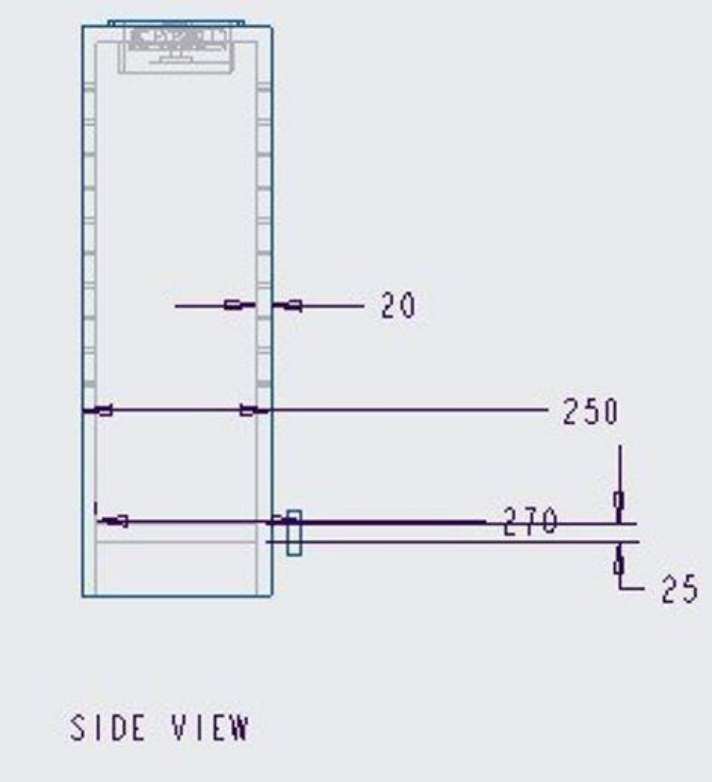

Fig 4.3 Side View

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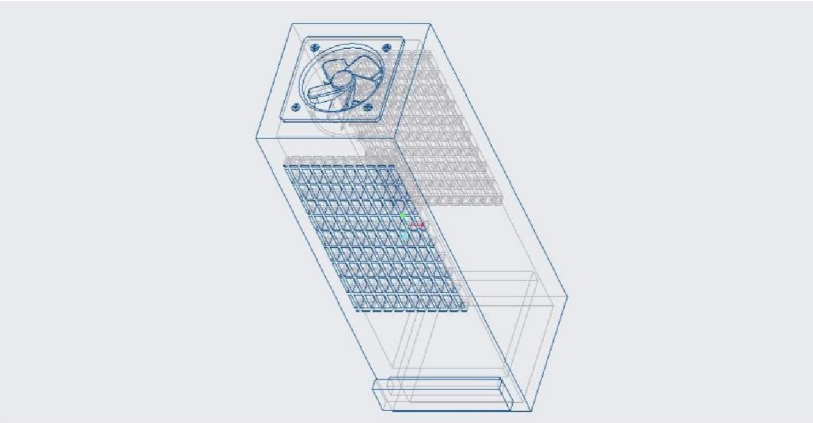

Fig.4. 4 3D model

V. PROCESS INVOLVED IN FABRICATION

Wood cutting

Wood cutting is the process of dividing wood into smaller pieces or shaping it for various purposes such as construction, carpentry, woodworking, and fuel. The process involves several techniques and tools, each suited to different cutting requirements and wood types.

Drilling

The drilling process involves creating holes or cavities in a material using a rotating cutting tool called a drill bit.

Wood Grinding

Wood grinding is a mechanical process that involves reducing wooden materials into smaller particles or powders using specialized equipment known as wood grinders or wood chippers. This process is commonly employed in industries such as woodworking, forestry, biomass processing, and recycling to transform large pieces of wood waste into usable products or materials.

VI. CONCLUSION

Though this project had some limitations regarding the filteration rate it can be achived to the best possible way by increasing the filter and orientiation of the fan. In conclusion, the development and implementation of a tailored dust collector system for stone crushers plants represent a proactive and strategic investment in environmental stewardship, worker safety, and operational efficiency, aligning with industry best practices and regulatory standards

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