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Development of Industrial Air Dust Removing and Air Cooling Machine for Heavily Polluted Areas of the Industry

Md. Fazle Rabbi

Department of Industrial Engineering and Management,
Khulna University of Engineering & Technology, Khulna-9203, Bangladesh
rfazle08@gmail.com

ABSTRACT

Industrial air dust removing and air cooling machine is constructed based on the fluid mechanics principles and application of applied chemistry. One air pump absorbed dusty air from the polluted industrial area and flows it into the main chamber. The main chamber purifies the dusty air by passing it through the water, plastic net and transparent cloth. Another air pump absorbs the pure air from the chamber and flows the pure air into in the industry again. As water temperature remains less than air temperature the air will be cooled and pure air will help the air conditioning system of the industry.

Key words: Absorb, Purify, Chamber, Air conditioning system

INTRODUCTION

Every year nearly 5.5 millions of people around the world die for directly or indirectly for air pollution according to the data of Global Burden Disease Projects. And the air pollution is more severe in the industrial area where air pollution is overlooked. But industries like jute mills, rice mills, flour mills, pesticides industries and even garments industries air pollution is in rampant march. Pollution can cause from particulates, biological molecules, or other harmful gases into Earth's atmosphere, causing disease, damage to other living organisms. Air pollution may come from reliable industries or natural sources. The atmosphere is a complex natural gaseous system that is essential to support life on planet Earth. Stratospheric ozone depletion due to air pollution has been recognized as a threat to human health as well as to the earth's ecosystems. Sometimes it becomes impossible for the workers to work within the factory or industry for the pollutants. Ao and Lee showed that higher level of pollutant NO removal can be achieved using TiO_2/AC filter compared to TiO_2 filter [1]. Goswami described the theoretical background of the technology and results of its effectiveness against volatile organic chemicals, bacteria, spores, and dust mite allergens [2]. Khan and Ghoshal presented the available Volatile Organic Compounds control technologies and their appropriateness [3]. Exposure to primary and secondary pollutants depends on the complex interplay of many sets off actors and processes, including cleaning product composition, usage, building occupancy, emission dynamics, transport and mixing, building ventilation, sorptive interactions with building surfaces, and reactive chemistry [4]. Nazaroff *et al.* developed a new technology for dust control by foam and studied the relationship between the foaming agent concentration and liquid surface tension [5]. Bunker reviewed the examinations of the origins of shaped film cooling and summarized the extant literature knowledge concerning the performance of film holes [6]. Fleming *et al.* reported an investigation into the competitive position of systems for heating and cooling which made use of ambient air as the working fluid [7]. Kakaras *et al.* discussed the state of the art in applications for reducing the gas turbine intake air temperature and examined the merits from integration of the different air-cooling methods in gas-turbine-based power plant [8]. Amin *et al.* proposed a revised version of E-crane to reduce the waste of raw materials during unloading from the vessels, which indirectly decrease the amount of dust from air but our developed air dust removing machine can help to reduce air dust directly in more efficient way [16].

Egan *et al.* made an experimental study on one of the smallest commercially available miniature. Fans, suitable for cooling portable electronic devices, used in conjunction with both finned and finless heat sinks of equal exterior dimensions [9]. Chan *et al.* presented the construction and use of poly (dimethylsiloxane) microfabricated soft polymer devices with mass spectrometry for protein analysis [10]. Helming showed techniques of selective removal of ozone

from the air sample [13] and Linder *et al*. presented simple and reliable technique for storing and delivering a sequence of reagents to a microfluidic device [14]. Malmstadt *et al*. presented a method for forming these sub-5-nm-thick free-standing structures based on a self-assembly process driven by solvent extraction in a microfluidic channel [15]. In the paper that is why it is proposed air purification machine mechanism which deals with both purification and cooling of the industrial air. The mechanism, here is used is new and sustainable for long time uses.

METHODOLOGY

Industrial air dust is one of the concerns of the industry and researchers try to solve it in different ways. In the modern technology the whole process must be in the semi or fully automated form. Eisert and Pawliszyn showed the first approach to developing an automated SPME-HPLC system [11]. Total gaseous mercury concentrations in Guiyang (China) were significantly elevated compared to the continental global background values and coal combustion from both industrial and domestic used was estimated to be the primary atmospheric source [12]. In this paper the whole process is also operated in the semi automated form.

Working Principle

1. The left housing of the wood frame contains a 220 Volt AC air pump which can absorb 233 litters of air per minute from the industrial area. But in the application the volume of air and speed of the air pump is too high. So a regulator is set in series in the air pump to reduce and adjust speed accordingly. One side of the air pump is set with a PVC pipes to absorb dusty air from the industry which actually deflate port of the air pump. And inflate port is set with plastic pipe to flow it into the water chamber.

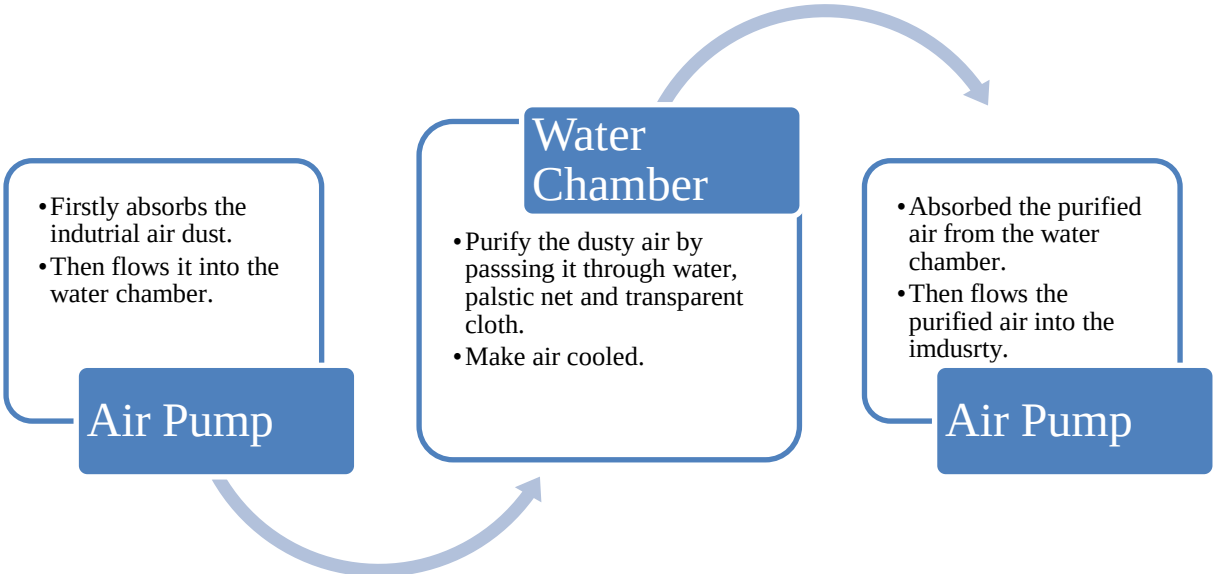

Fig. 1 Flow chart of working principles for Industrial Air Dust Removing and Air Cooling Machine

2. The middle housing of the frame contains a chamber containing water, plastic net and transparent cloth. Chamber facilitates with three steps air purifying procedure.

- Firstly the dusty air comes from the inflate port are being blown into the water. So the dust in the dusty air are being react with water and drown in the water. Again as the industrial air is hot and the water temperature is less. So the air would be cooled when flowing into water.
- Secondly the air would pass through the plastic net. So if there is vapours in the air, the vapours will be caught in the plastic net.
- Thirdly the transparent cloth would give the final filtration of the air and would provide the purified air in the opening side of the chamber.

3. The right side housing of the wood frame also contains a AC air pump which absorbs the purified air from the upper portion of the chamber. The cool and purified air is then inflated into the industry. The inflation speeds of the air pump can also be controlled by the regulator attached with the air pump. The selection of the inflation nozzle setting place is also important as the air flow could also be the reason of further contamination of air. The nozzle setting place should be dust free.

Fig. 2 Front view of Industrial Air Dust Removing and Air Cooling Machine

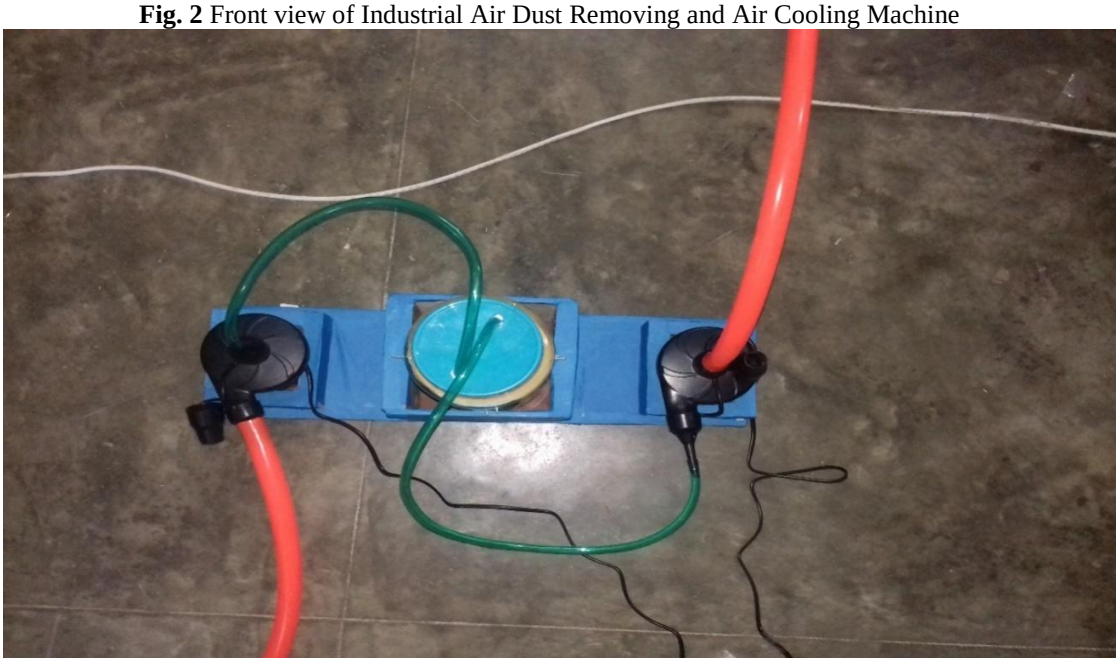

Fig. 3 Top view of Industrial Air Dust Removing and Air Cooling Machine

System Components

The components used in the industrial air dust removing and air cooling machine are not all of up to the mark. But as used in the porotype, they can be considered ok for the machine miniature.

Table -1 Components of Industrial Air Dust Removing and Air Cooling Machine

Name of the components	Pieces
AC Electric air pump	2
Regulator	2
PVC pipe\plastic pipe	2.50 Metre
Plastic net	0.50*.50 Metre
GI wire	0.10 Kg
Transparent cloth	1
Wood frame	1

RESULTS AND DISCUSSION

The experiment deals with the air purification and air cooling in the industrial area. Here the solvent used is water that actually will be varied according to the industries. Water would be perfect for the industries which emit organic

pollutants like jute industries or rice mills. But in the industries were chemical or heavy metal pollutants are emitted, there solvent would be changed accordingly such as for acid pollutant particles alkalis solvent and for alkalis pollutant particles acidic solvent. Actually more researches regard the solvent is needed for further development of the model. The design of the chamber does not facilitate with water change port. As it is a prototype, so customized design is needed for chamber to circulate the water. Air pump strength is weak as air pumps used here are not up to the mark to run long times. In the future design, sensor also can be used inside the chamber to calculate the air pressure and make it off automatically for excess air pressure. The machine would run better if it would be air tight so the air tightness should be reserved.

CONCLUSION

The air purifying and air cooling machine has been introduced here is without customized design and deep research. From the solvent to the air pump capacity all the components used here is needed further more research to make precise and perfect air purification and cooling machine. The cost in this regards are focused as main concerns of the experiment. Fluid properties and principles of fluid is utilized mainly to construct the machine. But actually needs deep research on fluid mechanics, chemistry and pollutant particles to make the machine perfect and precise for industry. Not suitable for long term use, Possibility of air lick in the chamber for rough use, too much air dusts in the water chamber may reduce effectiveness like limitations can only be removed when customized design would apply.

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