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ANALYSING AND REDUCING THE EMISSION GASES IN METAL CASTING PROCESS FOR POLLUTIN FREE ECO ENVIRONMENTAL USING POLLUTIN CONTROL MECHANISM

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ABSTRACT
The emissions gases released from metal casting process and affect the workers and human health. Therefore, in metal casting process, the Pollution Control Devices are used to avoid the harmful effect from released emissions gases. Many researches are going to reduce the harmful effect from in released emissions gases. More research work various ways of practice and effective survey was conducted among metal casting industries in the Tamilnadu and all over the India. From the literature survey, the most some of the Pollution Control Devices are used to reduce the released emissions gases effects and the data collected from this survey indicated that the metal casting industries in Tamilnadu have installed Pollution Control Devices such as cartridge filter, wet scrubber, wet plug collectors, dry plug collector, and a cyclone. From analyzing the all-Pollution Control Devices, the cartridge filter is the best pollution free controller of released emissions gases from metal casting process.
Keywords: Pollution, Particulate matter, Cartridge filter, wet scrubber, cupola furnace

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1. INTRODUCTION

Mostly more products are produced in metal casting process in the world. These industries emit air burns gasses and mix with atmosphere air. It is very dangerous to human beings, living organism and environmental. So, these kinds of industries are required to reduce emission levels by using pollution control Device (PCDs). In this research work clearly explain the effects of emission gasses from metal casting process and consider the need of PCDs and install the PCDs in the metal casting industries. In metal casting process include melting the raw metal, pouring these hot molten metals into specify mold cavity, allow to cooling these molten metal's in molds for solidifying, take the solidified metals from the molds, and cleaning these casting metals.

In world, large number of industries is produced various important household and company-oriented products like wet grinders, pumps and motors are largely manufactured by manually and automatic process. In order to the needs of more iron castings products are manufactured by these metal casting companies. Therefore, metal casting industry has been existing as a major industry sector in the world. In nowadays, increasing the population ratio, the usage of metal casting products also increased in the world. So the numbers of iron foundry industries are increased and the emission of polluted air bourns increased in the atmospheric air. These air bourns particles are removed from atmospheric air and improved the air quality for the quality life of people, living organism and environmental.

As a result, most of the iron foundries situated in world have installed PCDs. This situation has revealed the need to known the impact of PCDs on controlling the pollution airborne from iron foundries in world. In order to meet this research need, this reported in this paper was carried out. This is fulfilled by the PCD like cartridge filter to control and decreased the pollution from meal casting industries. The construction details of cartridge filter and its controls pollution in foundries will helpful to lower emissions from the iron foundries. The metal casting industry provides products that are widely used in products such as pumps, automobiles, and compressors. Thus, the contribution of the metal casting industry is vital and crucial to many economic in the world. At same time, the emissions from the metal casting industry cause pollution. These emissions are mineral dust and organic carbon emitted during the melting, sand casting and cleaning of castings Literature search was conducted to find research papers describing pollution control in metal casting foundries using PCDs. Some of the research papers were examined the pollution control model and devices used to control pollution in metal casting foundries. Other some papers were explained the important of the PCDs application in metal casting

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industries in different parts of the world is evaluated. Some of the articles were addressed the issues in both the first and second categories of articles. The information gathered from these three categories of articles is highlighted in the paper.

2. LIREURE REVIEW

Bai.L. et al. (2008) Investigate of yearly indoor PM 2.5 levels in the perspectives of health impacts and outdoor PM 2.5 levels in the perspectives of health impacts and control the air pollution various factors with different level of PM 2.5. Cheng, Y.H., et al. (2008) Analyzing and Measuring the various ultrafine particles in the airborne and determine the concentrations rate of ultrafine particles and he correct size distribution in an iron foundry. Cui, L, et. al.(2020) , Analyses the air pollution control measurement of airborne particles like organic and inorganic particles presents and co-benefits in the heavily air-polluted Jinan city of China, Guinot, B, et al. (2016) experimentally analyzing particulate matter characterization in a steelworks using conventional sampling and innovative deep observations about the matter characterization. Hirano,S. et.al. (2003), conducted various testing from diesel engine exhaust emitting gasses and aken Oxidative-stress potency of organic extracts of diesel exhaust and urban fine particles in rat heart micro vessel endothelial cells. Krishnaraj, R., ((2015), suggested that the benefits of pollution control devices in foundries and explain the important of the Contemporary and futuristic views of metal casing industries.

Kumar, A., et al, (2020) analyzing the Chemical method of trace metal contamination in the air of industrial area of Gajraula (U.P), India. Li, H., et.al. (2018), Investigating the environmental quality of air pollution and deterioration of airborne particle in the polluted air. They suggested about the human health hazard caused by heating emissions. Liu, X., et.al., (2019), experimentally investigating the Incorporating bio-accessibility into various health risk assessment of heavy metals in particulate matter originated from different sources of atmospheric pollution. P.Sethi, et al. (2008), suggested that the various conducting test towards cleaner technologies in small enterprises and micro enterprises. Pham, M.T.N., et al.((2019),analyzing the Characterization of PCDD and dioxin-like PCBs in flue gas from various thermal industrial processes like metal casing process in Vietnam. Ramaswamy K, et al. (2022) , Investigated about on Pollution Control Device (PCD) in iron foundry industry to reduce environmental chemicals from the polluted air. Biswas et al. (2001) discussed the reduction of exhaust emissions from the dome factory. These authors have listed some devices used in gas treatment plants connected to domes.

Some of these devices are cyclones, draft fans and chimney scrubbers. Peukert and Wadenpohl, (2001) described the construction and operation of the cyclone, electrostatic precipitator (ESP), wet scrubber, cloth filter and high-temperature filtrates. These authors did not explicitly address pollution control in iron foundries. However, the devices they describe can be used to control the emissions of exhaust gases coming from iron foundries.

Polizzi et al. (2007) studied air pollution caused by aluminum and cast-iron foundries in the Turin district of Italy. These authors found that the concentration of iron and aluminum particles varied during different periods of the study. These authors also found that pollution from these smelters affected human lung function examined the smoke levels of polychlorinated dibenzo-p-dioxin and dibenzofu. Yu et al. 2006 rans (PCDD / F) emitted by metallurgical industries in South Korea. These authors estimated the levels of these pollutants but did not identify their Pal et al. (2008) investigated the use of PCDs in iron foundries that are located and housed in a dome. These authors used a model called a high-throughput dome (CBD) to reduce carbon monoxide formation in the dome. The use of DBC is encouraged in India by the Swiss Development Control Agency (SDC) and the Energy Resources Institute (TERI). The construction and operation of the DBC model are illustrated in this article. It also lists the devices available to clean the exhaust from the dome.

These devices are centrifugal separators, low energy scrubbers and high intensity scrubbers. By applying the DBC, in the study described in this article, the Suspended Particulate Matter (SPM) have been reduced from 2000 mg / nm^3 (milligrams per normal cubic meter) to a value below 70 mg / nm^3. The installation of a Venturi wet scrubber resulted in the emission of SO2 at only 40 mg / nm^3.

Rabah, (1999) analyzed the profitability of installing PCDs in iron foundries in Egypt. PCDs listed in this article include cyclone, cloth filters, electro filters, and wet scrubbers. This author presented data on total particulate matter emissions (in mg / nm3) emitted from crucibles, short rotary, cupola, and electric induction furnaces from iron foundries in Egypt. After reviewing the economic considerations, this author concluded that wet scrubbing systems are the most suitable emission control equipment for iron foundry units in Egypt. Mukherjee, (2011)reported the scenario of foundries in Howrah district of India.

As Pal et al., (2008), this author also reported that SDC and TERI were encouraging foundries in India to use a DBC equipped with a venturi scrubber to control the pollution caused by dome operations. This author described the methodology of pollution control in foundries using three devices, namely the cyclone, the scrubber, and the fabric filter.

Fatta et al., (2004) have investigated the emissions from foundries in Cyprus. These authors presented several guidelines for preventing pollution and emissions from smelters. An interesting suggestion is that the induction furnace is preferable to the cupola furnace to control contamination from iron foundries. These authors studied the use of the wet scrubber and the venturi scrubber to reduce foundry emissions. Lv et al., (2011) studied the release of PCDD / F from iron foundries in China. They said the anti-pollution devices used in Chinese foundries are the fabric filter, the cyclone, and the wet scrubber.

3. METHODOLGY

3.1 AIR BORNE PARTICLES IN AMOSPHERE

Naturally occurring pollution include ash, soot, sulphur dioxide, salt spray, volcanic, combustion gases and etc. These particles are released during volcanic eruptions, forest fires, and gases fires. This kind of pollution is called as organic ype sources pollutions. Inorganic pollutions comprise mainly of heavy meals which are toxic or poisonous even low concentrations such as arsenic, mercury lead, and chromium. Hey can enter human body system through water food, and cause health issues. Figure 1 shows that the various air borne particles in an atmospheric air.

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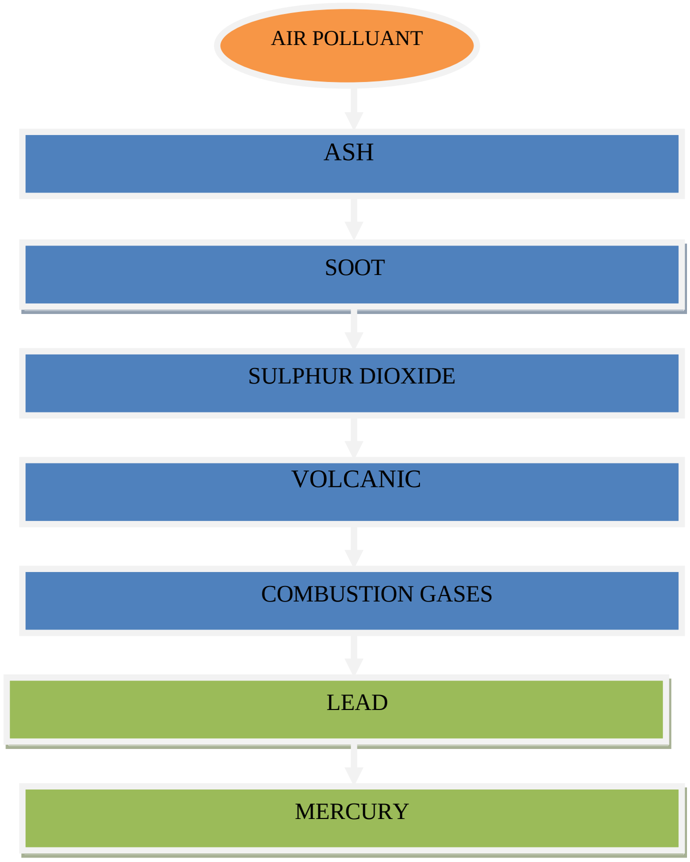

Fig.1.Air borne particles in atmosphere air

3.2 EFFECTS ON AIR BORNE PARTICLES

Air pollutants is an air contain that can bring effects on humans, living organism and environment. It can come from natural origin or by human and also exist in many conditions such as solid particles, liquid droplets or gases. Figure 2 shows that the various effects of an air borne particles in an atmospheric air.

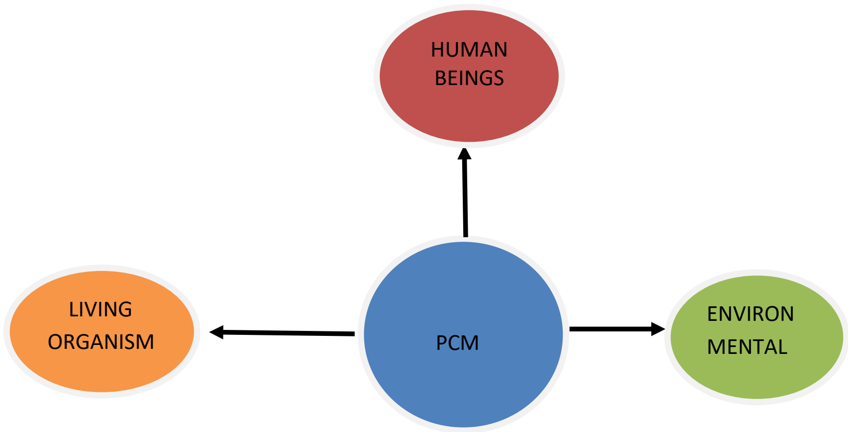

Fig 2. Effects on Air borne particles

4. RESULTS AND DISCUSSION:

Table1 shows that the various results of researchers are concentrating in reduce the particulate matters and the range from 400 mg/Nm^3 to 35 mg/Nm^3 using various pollution control mechanism such as Venturi scrubber Cyclone, Wet scrubber, Wet cap collector and Dry cap collector. In this paper indicate the latest methods of technology using in the pcm like a cartridge filter. This cartridge filter is emitted below 19 mg/Nm^3.

Table 1: **Particulate Matter Concentration Emission Review.**

S.No.	Pollution Control Device	Particulate Matter concentration
1	Cartridge filter	19
2	Wet scrubber	36
3	Cyclones	45
4	Venturi wet scrubber	60
5	Wet cap collector	90
6	Dry cap collector	395

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Table 2 shows that the Discharge rate of before and after Installing the PCM., The Cyclone PCM is used in Cupola furnace, discharge rate of before installing the PCM is in maximum level of 8350 liters/hour and the discharge rate of after installing the PCM is in minimum level of 4099 liters/hour. The wet cap collector PCM is used in Cupola furnace, discharge rate of before installing the PCM is in maximum level of 5670 liters/hour and the discharge rate of after installing the PCM is in minimum level of 4500 liters/hour. The dry cap collector PCM is used in Cupola furnace, discharge rate of before installing the PCM is in maximum level of 7960 liters/hour and the discharge rate of after installing the PCM is in minimum level of 5240 liters/hour. The venturi wet scrubber PCM is used in Cupola furnace, discharge rate of before installing the PCM is in maximum level of 4325 liters/hour and the discharge rate of after installing the PCM is in minimum level of 2043 liters/hour.

Table 2: **Discharge rate for** before **and after Installing the PCM**

Metal casting industries	**PCM**	**Furnace**	**Discharge rate (liters/hour)**	
			Before Installing the PCM	**After Installing the PCM**
1	Cyclone	Cupola	8350	4099
2	Wet cap Collector	Cupola	5670	4500
3	Dry cap collector	Cupola	7960	5240
4	Venturi wet Scrubber	Cupola	4325	2043
5	Venturi wet scrubber	Induction	9740	5490
6	Wet scrubber	Induction	8650	5180
7	Cartridge filter	Induction	190	45

The venturi wet scrubber PCM is used in Induction furnace, discharge rate of before installing the PCM is in maximum level of 9740 liters/hour and the discharge rate of after installing the PCM is in minimum level of 5490 liters/hour. The wet scrubber PCM is used in Induction furnace, discharge rate of before installing the PCM is in maximum level of 8650 liters/hour and the discharge rate of after

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installing the PCM is in minimum level of 5180 liters/hour. The Cartridge filter PCM is used in Induction furnace, discharge rate of before installing the PCM is in maximum level of 190 liters/hour and the discharge rate of after installing the PCM is in minimum level of 45 liters/hour.

Table 3: **Concentration of pollutants of PCM**

Metal casting industries	**PCM**	**Furnace**	**Concentration of pollutants in (mg/nm^3)**			
			SO_2	**NOx**	**CO_2**	**CO**
1	Cyclone	Cupola	2.6	1.6	1.9	0.2
2	Wet cap Collector	Cupola	9.5	1.8	3.5	0.45
3	Dry cap collector	Cupola	31	5.3	4.1	0.5
4	Venturi wet Scrubber	Cupola	24	8	3	0.25
5	Venturi wet scrubber	Induction	8	2.9	2	0.4
6	Wet scrubber	Induction	17	4.6	2.5	0.3
7	Cartridge filter	Induction	1	0.7	1.5	0.1

Table 3 shows that the concentration pollutants of PCM in various furnace. The dry cap collector PCM is used in Cupola furnace, concentration pollutants of SO_2 is in maximum level of 31 mg/nm^3 and the concentration pollutants of CO is in minimum level of 0.5 mg/nm^3. The Cartridge filter PCM is used in Induction furnace, concentration pollutants of SO_2 is in maximum level of 1 mg/nm^3 and the discharge rate of CO is in minimum level of 0.1 mg/nm^3 .

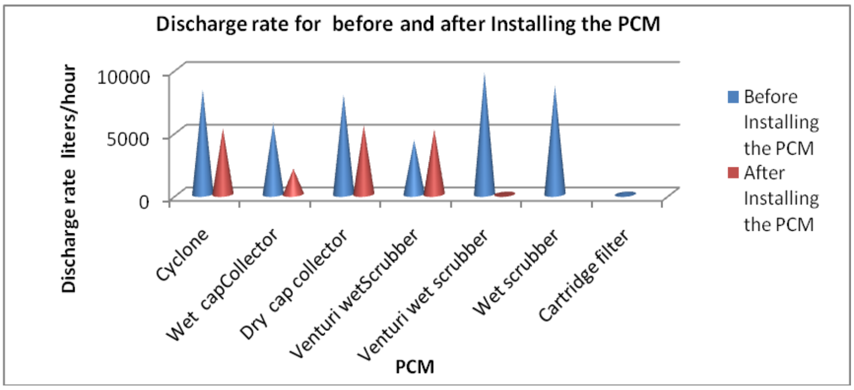

Fig 4 Impact on pollution before installing the PCD

Figure 4 shows that the discharge rate for before and after Installing the PCM. The discharge rates on pollutions are higher than the normal value, when without installing the PCD. The maximum range of discharge rate of before Installing the PCM for Venturi wet scrubber in induction furnace is 9740 liters/hour. The minimum range of discharge rate of after Installing the PCM for Cartridge filter in an induction furnace is 45 liters/hour.

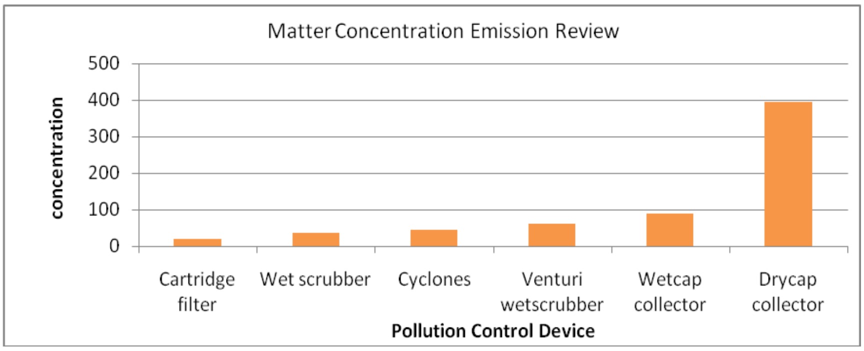

Fig 5 Particulate Matter Concentration Emission Review

Figure 5 shows that the particulate matter concentration emission review of various pollution control devices such as Cartridge filter, Wet scrubber, Cyclones, Venturi wet scrubber, Wet cap collector, Wet cap collector, Dry cap collector, Dry cap collector are used to reduction of particulate matter. The mater concentration emission value of Wet scrubber is 36, Cyclones is 45, Venturi wet scrubber is 60, Wet cap collector is 90 and Dry cap collector is 395. The minimum value of mater concentration emission is 19 from Cartridge filter of in this research work.

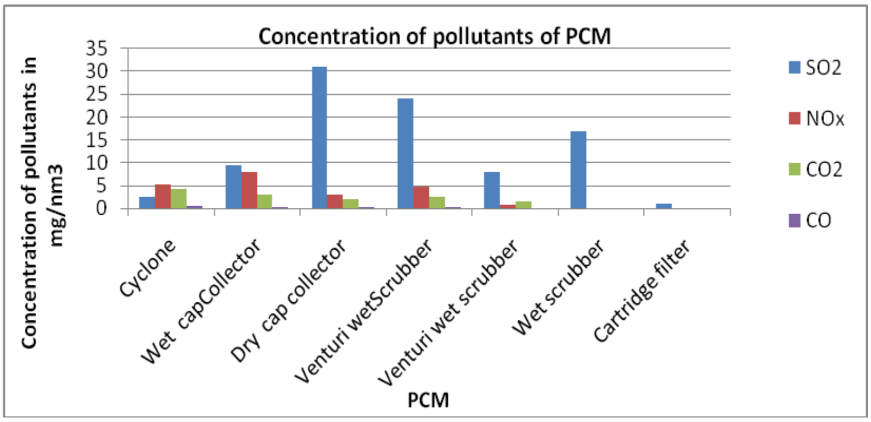

Fig 6 Concentration of pollutants of using PCM

Figure 6 Shows that the concentration of pollutants in mg/nm^3 for various pollution control devices such as Cartridge filter, Wet scrubber, Cyclones, Venturi wet scrubber, Wet cap collector and Dry cap collector are used to reduction of particulate matter for SO_2,NO_X, CO_2 and CO. The maximum concentration of pollutants of dry cap collector for SO_2 is 31 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for SO_2 is 1 mg/nm^3.The maximum concentration of pollutants of dry cap collector for NO_X is 5.3 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for NO_X is 0.7 mg/nm^3.The maximum concentration of pollutants of dry cap collector for CO_2 is 4.1 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for CO_2 is 0.7 mg/nm^3. The maximum concentration of pollutants of dry cap collector for CO is 0.5 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for CO is 0.1 mg/nm^3.

Fig. 7 Shows that the Bi-chart of concentrating in reduction of particulate matter of various pollution control mechanism. The Cartridge filter gave the minimum concentrating in reduction of particulate matter of rest of pollution control devices. The Dry cap collector gave the more concentrating in reduction of particulate matter.

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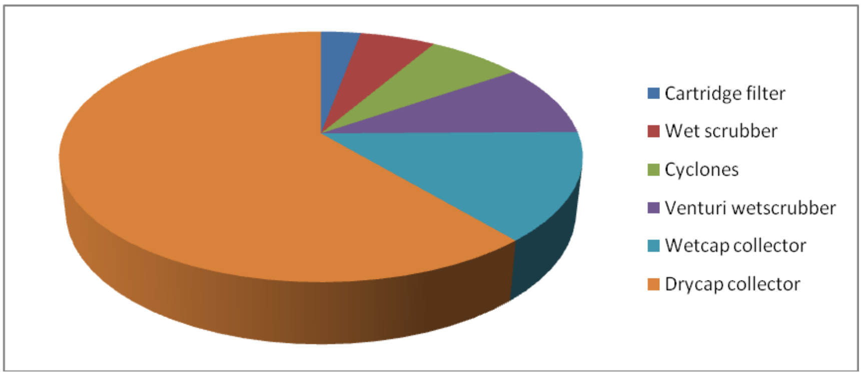

Fig 7 Concentrating in reduction of particulate matter

CONCLUSION

Metal casting industries have been manufacturing products necessary to maintain and increase the quality of human life. More advanced technologies and methods are used in metal casting process to produce high quality products with large production. At same time the factors to be considered such as high costs, legal laws, and lack of manpower skilled workforce. The development to be considered and growth of meal casing industries has the Concentrating in reduction of particulate matter in the emission of flue gases from these industries and does not affected the environment, healthy life of humans and other living organism. After a literature review, relevant data was collected from the industries in the world. The data collected indicates that the levels of contamination released by the modification of induction furnace used in meal casting industries are emitting lower polluted air borne in the emitting gases. To reduce the airborne in emitting gases from metal casting industries, some PCDs are installed in these industries for pollution prevention. The particulate matter concentration emission review of various pollution control devices such as Cartridge filter, Wet scrubber, Cyclones, Venturi wet scrubber, Wet cap collector, Wet cap collector, Dry cap collector, Dry cap collector are used to reduction of particulate matter in the emission gases from metal casing industries. The mater concentration emission value of Wet scrubber is 36, Cyclones is 45, Venturi wet scrubber is 60, Wet cap collector is 90 and Dry cap collector is 395. The maximum concentration of pollutants of dry cap collector for SO_2 is 31 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for SO_2 is 1 mg/nm^3.The maximum concentration of pollutants of dry cap collector for NO_X is 5.3 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for NO_X is 0.7 mg/nm^3.The maximum concentration of pollutants of dry cap collector for CO_2 is 4.1 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for CO_2 is 0.7 mg/nm^3. The maximum concentration of pollutants of dry cap collector for CO is 0.5 mg/nm^3 and the minimum concentration of pollutants of Cartridge filter for CO is 0.1 mg/nm^3. Finally this article concludes with an evaluation of the need to analyzing meal casting industries and examines the practice of using an induction furnace and a cartridge filter to reduce airborne particles, when using the pollution control mechanism in metal casting industries.

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