



# Air pollution control using Split Stream Cyclonic Dust Collector

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**ABSTRACT** -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 cleaners, which use disposable filters to remove dust. Dust collectors are used in many processes to either recover valuable granular solid or powder from process streams, or to remove granular solid pollutants from exhaust gases prior to venting to the atmosphere. Dust collection is an online process for collecting any process-generated dust from the source point on a continuous basis. Dust collectors may be of single unit construction, or a collection of devices used to separate particulate matter from the process air. They are often used as an air pollution control device to maintain or improve air quality. Proper maintenance of your dust collector is important in extending filter life and ensuring the collector consumes as little energy as possible. Dust collector owners and operators sometimes assume they're being frugal by replacing a single damaged filter rather than all the filters. While this simpler and quicker fix may seem like an economical choice, it may actually result in more frequent filter replacements, more downtime, and higher electric bills – meaning increased cost. In the traditional method the filter based dust collector facing these issues in their process. So the Split Stream is a mechanical "counter-cyclonic" dust collector. Unlike conventional cyclone dust collectors, the Split Stream utilizes a powerful secondary air stream which protects the inner walls from abrasive wear and directs incoming dust toward the collection hopper. This unique design yields higher collection efficiency than a traditional cyclone dust collector and allows the unit to be installed in a horizontal or vertical configuration without reducing efficiency. Because **the Split Stream Dust Collector uses no filter bags or cartridges**, it can easily handle high dust loads with minimal maintenance requirements. An added benefit for this customer's process was the ability to use ambient air for the secondary air stream.

**Keywords-** air quality, Split Stream, cartridges, hopper.

## INTRODUCTION-

**Air pollution** occurs when harmful substances including particulates and biological molecules are introduced into Earth's atmosphere. It may cause diseases, allergies or death in humans; it may also cause harm to other living organisms such as animals and food crops, and may damage

the natural or built environment. Human activity and natural processes can both generate air pollution.

Indoor air pollution and poor urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report. According to the 2014 WHO report, air pollution in 2012 caused the deaths of around 7 million people worldwide, an estimate roughly matched by the International Energy Agency.

An air pollutant is a substance in the air that can have adverse effects on humans and the ecosystem. The substance can be solid particles, liquid droplets, or gases. A pollutant can be of natural origin or man-made. Pollutants are classified as primary or secondary. Primary pollutants are usually produced from a process, such as ash from a volcanic eruption. Other examples include carbon monoxide gas from motor vehicle exhaust, or the sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. Ground level ozone is a prominent example of a secondary pollutant. Some pollutants may be both primary and secondary: they are both emitted directly and formed from other primary pollutants. Primary pollutants produced by human activity include:

**Carbon dioxide (CO<sub>2</sub>)** - This is by far the most emitted form of human caused air pollution. Although CO<sub>2</sub> is currently only about 405 parts per million in earth's atmosphere, billions of metric tons of CO<sub>2</sub> are emitted annually by burning of fossil fuels. CO<sub>2</sub> increase in earth's atmosphere has been accelerating.

**(SO<sub>x</sub>)** - particularly sulfur dioxide, a chemical compound with the formula SO<sub>2</sub>. SO<sub>2</sub> is produced by volcanoes and in various industrial processes. Coal and petroleum often contain sulfur compounds, and their combustion generates sulfur dioxide. Further oxidation of SO<sub>2</sub>, usually in the presence of a catalyst such as NO<sub>2</sub>, forms H<sub>2</sub>SO<sub>4</sub>, and thus acid rain. This is one of the causes for concern over the environmental impact of the use of these fuels as power sources.

**Nitrogen oxide (NO<sub>x</sub>)** - Nitrogen oxides, particularly nitrogen oxide, are expelled from high temperature combustion, and are also produced during thunderstorms by electric discharge. They can be seen as a brown haze dome above or a plume downwind of cities. Nitrogen dioxide is a chemical compound with the formula NO<sub>2</sub>. It is one of several nitrogen oxides. One of the most prominent air pollutants, this reddish-brown toxic gas has a characteristic sharp, biting odor.

**CO** is a colorless, odorless, toxic yet non-irritating gas. It is a product of incomplete combustion of fuel such as natural gas, coal or wood. Vehicular exhaust is a major source of carbon monoxide.

**VOC** - VOCs are a well-known outdoor air pollutant. They are categorized as either methane (CH<sub>4</sub>) or non-methane (NMVOCs). Methane is an extremely efficient greenhouse gas which contributes to enhanced global warming. Other hydrocarbon VOCs are also significant greenhouse gases because of their role in creating ozone and prolonging the life of methane in the atmosphere. This effect varies depending on local air quality. The aromatic NMVOCs benzene, toluene and xylene are suspected carcinogens and may lead to leukemia with prolonged exposure. 1,3-butadiene is another dangerous compound often associated with industrial use.

Particulates created from gaseous primary pollutants and compounds in photochemical smog. Smog is a kind of air pollution. Classic smog results from large amounts of coal burning in an area caused by a mixture of smoke and sulfur dioxide. Modern smog does not usually come from coal but from vehicular and industrial emissions that are acted on in the atmosphere by UV light from the sun to form secondary pollutants that also combine with the primary emissions to form photochemical smog. Minor air pollutants include: A large number of minor air pollutants are regulated in USA under the clean air Act and in Europe under the Air Framework Directive.

A variety of persistent air pollutant which can attach to particulates Persistent organic pollutants (POPs) are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes. Because of this, they have been observed to persist in the environment, to be capable of long-range transport, bioaccumulate in human and animal tissue, biomagnify in food chains, and to have potentially significant impacts on human health and the environment.

**Stationary sources** include smoke stacks of power plants, manufacturing facilities (factories) and waste incinerators, as well as furnaces and other types of fuel-burning heating devices. In developing and poor countries, traditional biomass burning is the major source of air pollutants; traditional biomass includes wood, crop waste and dung.

**Mobile sources** include vehicles, marine vessels, and aircraft.

Controlled burn practices in agriculture and forest management. Controlled or prescribed burning is a technique sometimes used in forest management, farming, prairie restoration or greenhouse gas abatement. Fire is a natural part of both forest and grassland ecology and controlled fire can be a tool for foresters. Controlled burning stimulates the germination of some desirable forest trees, thus renewing the forest.

**Fumes** from paint, hair spray, varnish and other solvents

**Waste deposition** in landfills, which generate methane. Methane is highly flammable and may form explosive mixtures with air. Methane is also an asphyxiant and may displace oxygen in an enclosed space. Asphyxia or suffocation may result if the oxygen concentration is reduced to below 19.5% by displacement.

**Military resources**, such as nuclear weapons, toxic gases, germ warfare and rocketry

#### **Natural sources:**

from natural sources, usually large areas of land with little or no vegetation methane, emitted by the digestion of food by animals, for example cattle radon gas from radioactive decay within the earth's crust. Radon is a colorless, odorless, naturally occurring, radioactive noble gas that is formed from the decay of radium. It is considered to be a health hazard. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as the basement and it is the second most frequent cause of lung cancer, after cigarette smoking. smoke and carbon monoxide from wildfires Vegetation, in some regions, emits environmentally significant amounts of VOCs on warmer days. These VOCs react with primary anthropogenic pollutants—specifically, NO<sub>x</sub>, SO<sub>2</sub>, and anthropogenic organic carbon compounds — to produce a seasonal haze of secondary pollutants. Black gum, poplar, oak and willow are some examples of vegetation that can produce abundant VOCs. The VOC production from these species result in ozone levels up to eight times higher than the low-impact tree species. lack of ventilation indoors concentrates air pollution where people often spend the majority of their time. Radon (Rn) gas, a carcinogen, is exuded from the Earth in certain locations and trapped inside houses. Building materials including carpentry and plywood emit H<sub>2</sub>CO gas. Paint and solvents give off VOC as they dry. Lead paint can degenerate into dust and be inhaled. Intentional air pollution is introduced with the use of air freshener incense and other scented items. Controlled wood fires in stoves and fireplaces can add significant amounts of smoke particulates into the air, inside and out. Indoor pollution fatalities may be caused by using and other chemical sprays indoors without proper

ventilation. Carbon monoxide poisoning and fatalities are often caused by faulty vents and chimneys, or by the burning of charcoal indoors or in a confined space, such as a tent. Chronic carbon monoxide poisoning can result.

### LITERATURE REVIEW-

**Vladmir Zivica (April 2003)** studied the causes for corrosion on reinforcement are studied where the action carbonation and chloride attack are given preliminary importance.

**Ted R. Mortan (December 1973)** in this paper talks about fiber glass reinforced plastics used in many applications; from boats to missiles. The article is mainly concerned with the use of fiber glass reinforced plastics for corrosion resistant applications.

**Anees U. Malik (March 2001)** the paper deals with studies carried out on the corrosion and mechanical behaviour of fusion bonded epoxy (FBE) coating on steel in aqueous media which include product water, distilled water and saline water. The mechanical testing's on coating include adhesion, bending and Cathodic disbondment testing.

### CONCLUSION-

In a June 2014 study conducted by researchers at the University of Rochester Medical Center, published in the journal *Environmental Health Perspectives* it was discovered that early exposure to air pollution causes the same damaging changes in the brain as autism and schizophrenia. The study also shows that air pollution also affected short-term memory, learning ability, and impulsivity. Lead researcher Professor Deborah Cory-Slechta said that "When we looked closely at the ventricles, we could see that the white matter that normally surrounds them hadn't fully developed. It appears that inflammation had damaged those brain cells and prevented that region of the brain from developing, and the ventricles simply expanded to fill the space. Our findings add to the growing body of evidence that air pollution may play a role in autism, as well as in other neurodevelopmental disorders." Air pollution has a more significant negative effect on males than on females.

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