ANALYSIS OF AIR POLLUTANTS

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ABSTRACT

Air pollution occurs in many forms but can generally be thought of as gaseous and particulate contaminants that are present in the earth’s atmosphere. Gaseous pollutants include sulfur dioxide (SO₂), nitrogen oxides (NOₓ), ozone (O₃), carbon monoxide (CO), volatile organic compounds (VOC), hydrogen sulfide (H₂S), hydrogen fluoride (HF), and various gaseous forms of metals. These pollutants are emitted from large stationary sources such as fossil fuel fired power plants, smelters, industrial boilers, petroleum refineries, and manufacturing facilities as well as from area and mobile sources. They are corrosive to various materials which causes damage to cultural resources, can cause injury to ecosystems and organisms, aggravate respiratory diseases, and reduce visibility. Hence the analysis of such air pollutants will be useful for protecting nature.

1. INTRODUCTION

Air pollution occurs when gases, dust particles, fumes or odor are introduced into the atmosphere in a way that makes it harmful to humans, animals and plant. This is because the air becomes dirty. The Earth is surrounded by a blanket of air called the atmosphere. The atmosphere helps protect the Earth and allow life to exist. Without it, we would be burned by the intense heat of the sun during the day or frozen by the very low temperatures at night.

Anything additional gas, particles or odours that are introduced into the air to destroy this natural balance can be called air pollution. Particulates come in both large and small or “fine” solid forms. Large particulates include substances such as dust, asbestos fibers, and lead. Fine particulates include sulfates (SO₄) and nitrates (NO₃). Important sources of particulates are power plants, smelters, mining operations, and automobiles. Asbestos and lead affect organisms, while sulfates and nitrates not only cause health problems, but also contribute to acid rain or acid deposition and a reduction in visibility. Particulate matter, a term sometimes used instead of particulates, refers to the mixture of solid particles and liquid droplets found in the air.

Toxic air pollutants are a class of chemicals which may potentially cause health problems in a significant way. The sources of toxic air pollutants include power plants, industries, pesticide application, and contaminated windblown dust. Persistent toxic pollutants, such as mercury, are of particular concern because of their global mobility and ability to accumulate in the food chain. More research is needed to fully understand the fate and effects of mercury and the many other toxic pollutants.

2. RELATED WORK

Many air pollution systems in various areas were reported in recent literatures. In 2008, Air pollution monitoring system based on geo sensor network was presented by Young Jin Jung, Yang Koo Lee, Dong Gyu Lee, Keun Ho Ry, Silvia Nittel. This paper presented the concept for network of sensors to monitor the pollution levels. Those sensors are connected through the server for storing the results. In 2010, A Mobile GPRS-Sensors Array for Air Pollution Monitoring was presented by A. R. Al-Ali, Imran Zualkermern, and Fadi Aloul. The system helps to send the sensor values through Mobile GPRS to remote server.

3. AIR POLLUTANTS

Things that pollute the air are called pollutants. Examples of pollutants include nitrogen oxides, carbon monoxides, hydrocarbons, sulphur oxides, sand or dust particles, and organic compounds that can evaporate and enter the atmosphere. There are two types of pollutants

3.1 Primary pollutants

Primary pollutants are those gases or particles that are pumped into the air to make it unclean. They include carbon monoxide from automobile (cars) exhausts and sulfur dioxide from the combustion of coal.

3.2 Secondary pollutants

When pollutants in the air mix up in a chemical reaction, they form an even more dangerous chemical. Photochemical smog is an example of this, and is a secondary pollutants. When pollution occurs in the air, it can easily travel and spread, and because we breathe in air, we cannot easily avoid it. Air pollution can result from both human and natural actions. Natural events that pollute the air include forest fires, volcanic eruptions, wind erosion, pollen dispersal, evaporation of organic compounds and natural radioactivity. Pollution from natural occurrences are not very often.
4. SOURCES OF AIR POLLUTANTS

Emissions from industries and manufacturing activities are long tubes erected high into the air, with lots of smoke and fumes coming out of it. Waste incinerators, manufacturing industries and power plants emit high levels of carbon monoxide, organic compounds, and chemicals into the air. This happens almost everywhere that people live. Petroleum refineries also release lots of hydrocarbons into the air.

Burning Fossil Fuels

After the industrial age, transportation has become a key part of our lives. Cars and heavy duty trucks, trains, shipping vessels and airplanes all burn lots of fossil fuels to work. Emissions from automobile engines contain both primary and secondary pollutants. This is a major cause of pollution, and one that is very difficult to manage. This is because humans rely heavily on vehicles and engines for transporting people, good and services. Fumes from car exhausts contain dangerous gases such as carbon monoxide, oxides of nitrogen, hydrocarbons and particulates. On their own, they cause great harm to people who breathe them. Additionally, they react with environmental gases to create further toxic gases.

Household and Farming Chemicals

Crop dusting, fumigating homes, household cleaning products or painting supplies, over the counter insect/pest killers, fertilizer dust emit harmful chemicals into the air and cause pollution. In many case, when we use these chemicals at home or offices with no or little ventilation, we may fall ill if we breathe them.

5. CAUSE OF AIR POLLUTANTS

There are some six common pollutants playing major role in air pollution. The source of such gases and their individual effects to the environment are discussed below.

5.1 Carbon monoxide

- Fuel combustion from vehicles and engines.
- Reduces the amount of oxygen reaching the body’s organs and tissues; aggravates heart disease, resulting in chest pain and other symptoms.

5.2 Ground level Ozone (O3)

- Secondary pollutant formed by chemical reaction of volatile organic compounds (VOCs) and NOx in the presence of sunlight.
- Decreases lung function and causes respiratory symptoms, such as coughing and shortness of breath, and also makes asthma and other lung diseases get worse.

5.3 Lead (Pb)

- Smelters (metal refineries) and other metal industries; combustion of leaded gasoline in piston engine aircraft; waste incinerators (waste burners), and battery manufacturing.
- Damages the developing nervous system, resulting in IQ loss and impacts on learning, memory, and behavior in children. Cardiovascular and renal effects in adults and early effects related to anaemia.

5.4 Nitrogen Dioxide (NO2)

- Fuel combustion (electric utilities, big industrial boilers, vehicles) and wood burning.
- Worsens lung diseases leading to respiratory symptoms, increased susceptibility to respiratory infection.

5.5 Particulate Matter (PM)

- This is formed through chemical reactions, fuel combustion (e.g., burning coal, wood, diesel), industrial processes, farming (plowing, field burning), and unpaved roads or during road constructions.
- Short-term exposures can worsen heart or lung diseases and cause respiratory problems. Long-term exposures can cause heart or lung disease and sometimes premature deaths.

5.6 Sulfur Dioxide (SO2)

- SO2 come from fuel combustion (especially high-sulfur coal); electric utilities and industrial processes as well as and natural occurrences like volcanoes.
- Aggravates asthma and makes breathing difficult. It also contributes to particle formation with associated health effects.

6. EFFECTS OF AIR POLLUTANTS

6.1 Acidification

Chemical reactions involving air pollutants can create acidic compounds which can cause harm to vegetation and buildings. Sometimes, when an air pollutant, such as sulfuric acid combines with the water droplets that make up clouds, the water droplets become acidic, forming acid rain. When acid rain falls over an area, it can kill trees and harm animals, fish, and other wildlife.
Acid rain destroys the leaves of plants. When acid rain infiltrates into soils, it changes the chemistry of the soil making it unfit for many living things that rely on soil as a habitat or for nutrition. Acid rain also changes the chemistry of the lakes and streams that the rainwater flows into, harming fish and other aquatic life.

6.2 Eutrophication
Rain can carry and deposit the Nitrogen in some pollutants on rivers and soils. This will adversely affect the nutrients in the soil and water bodies. This can result in algae growth in lakes and water bodies, and make conditions for other living organism harmful.

6.3 Ground level ozone
Chemical reactions involving air pollutants create a poisonous gas ozone (O3). Gas Ozone can affect people’s health and can damage vegetation types and some animal life too.

6.4 Particulate matter
Air pollutants can be in the form of particulate matter which can be very harmful to our health. The level of effect usually depends on the length of time of exposure, as well the kind and concentration of chemicals and particles exposed to. Short-term effects include irritation to the eyes, nose and throat, and upper respiratory infections such as bronchitis and pneumonia. Others include headaches, nausea, and allergic reactions. Short-term air pollution can aggravate the medical conditions of individuals with asthma and emphysema. Long-term health effects can include chronic respiratory disease, lung cancer, heart disease, and even damage to the brain, nerves, liver, or kidneys. Continual exposure to air pollution affects the lungs of growing children and may aggravate or complicate medical conditions in the elderly.

7. AIR POLLUTION PREVENTION, MONITORING AND SOLUTION.
Solution efforts on pollution is always a big problem. this is why prevention interventions are always a better way of controlling air pollution. these prevention methods can either come from government (laws) or by individual actions. in many big cities, monitoring equipment have been installed at many points in the city. authorities read them regularly to check the quality of air. let's see more below.

7.1 Government (or community) level prevention
1) Governments throughout the world have already taken action against air pollution by introducing green energy. Some governments are investing in wind energy and solar energy, as well as other renewable energy, to minimize burning of fossil fuels, which cause heavy air pollution
2) Governments are also forcing companies to be more responsible with their manufacturing activities, so that Even though they still cause pollution, they are a lot controlled.
3) Companies are also building more energy efficient cars, which pollute less than before.

7.2 Individual Level Prevention
1) Encourage your family to use the bus, train or bike when commuting. If we all do this, there will be less cars on road and less fumes.
2) Use energy (light, water, boiler, kettle and fire woods) wisely. This is because lots of fossil fuels are burned to generate electricity, and so if we can cut down the use, we will also cut down the amount of pollution we create.
3) Recycle and re-use things. This will minimize the dependence of producing new things. Remember manufacturing industries create a lot of pollution, so if we can re-use things like shopping plastic bags, clothing, paper and bottles, it can help

8. CONCLUSION
Thus the Result shows the pollution limits and their causes. Hence it is advisable to maintain the pollutants limit within the specified value.

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