

Impact of Petrochemicals industries on the environment

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Abstract:

Petrochemicals are the derivative of the petroleum refinery products. Other than the petroleum products, natural gas and crude oil derivatives are also considered as petrochemicals. Petroleum industries are the source of these compounds by the many process. Petrochemical industries play a vital role in the development of economy. In spite of this, they give an adverse impact on the environment and health of living being by emitting the toxic chemical compounds. These toxic compounds are generally Volatile Organic Compounds, greenhouse gases and particulate matter that are emitted in the environment and affect the environment in the form of water and soil pollution, air pollution, noise pollution and so on. According to World Health Organization (WHO), air and water pollution have been identified as the largest environmental and health risk. Both types chronic and acute of health diseases are occurred such as ulcer, allergy, cancer, and liver and kidney problems to the living beings. This paper shows the different sources of emission of toxic chemical compounds and their adverse effect on the environment.

Keywords: Petrochemicals, Volatile Organic Compounds, Economy

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Introduction

The rapid growth of population is coupled with the economic and industrial activities. But the efficient use of natural resources is very low rate due to which the ecological balance is disrupted. Some serious problems related to environmental imbalances are inappropriate land use change, pollution, and the destruction of natural resources. These problems should be reduced for the land development and regional development by taking the advantage of the features and functionality of each part of the country for planning.

A major part of manufacturing industry is petrochemicals sector that has various connection with other sectors in the form of economy. Petrochemicals are also called petroleum distillates, a large group of chemicals which are derived from the petroleum and natural gases. They are derived as by-products from either direct manufacturing or indirect manufacturing. Due to economical and readily accessible, oil and natural gas are considered as the main sources for petrochemicals.

Petrochemicals play a vital role in society as they are used in food, clothing, shelter and leisure. Many industries use the petrochemicals in the formation of polymers, synthetic fibers, synthetic rubber, plastics, soaps and detergents, solvents, drugs, fertilizers, pesticides, explosives, paint and flooring and insulating materials. There are certain compounds which do not included in the petrochemicals such as lubricating oil, kerosene, diesel fuel, gasoline, and LPG and jet fuel.

Solid waste and sludge are generated by the refinery and petrochemical plants. These waste composed of organic and inorganic compounds (heavy metals). Petrochemical industries release waste water that are categorized on the basis of presence of large quantity of polycyclic and aromatic hydrocarbons, phenols, metal derivatives, surface active substances, sulfides, naphthylenic acids and other chemicals.

An important source for the manufacturing of domestic industries is petrochemical industry that has a special potential and place in national economy. For the development of petrochemical industry, the environment impact assessment is very important factor. For achieving the goals of sustainable development, Environment impact assessment is one of the suitable method and planning tool that can identify potential environmental effects after the implementation of petrochemical projects.

Impact of Petrochemical Industries

Impact on Environment

With the innumerable useful products, petrochemicals also give the adverse effects to the health of living organisms and earth's ecosystem. These chemical products release in the environment and give different problems such as air, water, and soil pollution. An important environmental pollutants 'Aromatic compounds' introduced into the environment by various sources i.e., natural oil seeps, industry waste products and emissions, oil storage wastes, accidental spills from oil tankers coal tar processing wastes, petrochemical industrial effluents and emissions etc. The global warming is due to the greenhouse gases which are produced by the petrochemical industry. These petrochemical industry gives other environmental impacts including ozone layer depletion, acid rain, air pollution etc.

Access roads, trucking, storage ponds, and other surface operations such as piping, storage and wellpad construction occupy the large surface of the land due to which the natural value like trees, vegetation and biodiversity are losing day by day. It also give adverse effects on the ecosystem and allow to higher migration of emissions, contaminants and sediments.

Air pollution from petroleum industries

Petroleum refining and petrochemical industries emits chemical by the various sources. There are some major categories of emission sources:

- 1. Process Emissions:** The processes such as separation, conversions and treating process (Cracking, Reforming, and Isomerization) take place in the petroleum refining and petrochemical industries. The emission produced from these processes is known as process emission that are generally released from process vents, sampling points, safety valve releases and similar items.
- 2. Combustion Emission:** Burning fuels generate the combustion emissions that is used for the transportation purposes. The kind of fuel decides the nature and quantity of emissions. Stationary fuel combustion sources such as furnaces, heaters and steam boilers can release the combustion emissions but these combustion can be released from the flares.
- 3. Fugitive Emission:** The sudden leak of vapors from the equipments or pipelines and continuous small leaks from seals on equipment are included in the fugitive emissions. Vents and flares do not release fugitive emissions. Valves, pump and compressor and piping flanges are the sources of fugitive emissions. This emission has very growing concern that needs an effective control for mitigation

and lead detection and repair (LDAR) programs. The emission can be minimized by the proper design and procedure alterations.

4. **Storage and Handling Emissions:** Storing and handling of natural gas, oil and its derivatives cause emission. This storing and handling problem is seen in every petroleum refining and petrochemical industry. Many products of refinery is transported through pipelines and some other such as marine vessels and trucks due to which emission occurs during the material transfer to these vehicles. The problem of emission can be reduced by increasing the water quantity in the tank by which there is the decrement in the vapor phase volume (VOC)
5. **Auxiliary Emissions:** It generate from different units such as cooling towers, boilers, sulphur recovery units and wastewater treatment units. When water phase comes into the contact with air at the time of cooling process, the cooling towers show atmospheric emissions in the form of gases. While in the wastewater treatment units, the stripping of the VOCs from contaminated wastewater in the pond, pits, drains or aeration basins cause emissions.

Water Pollution

The presence of solid, liquid and gaseous contaminants in the water above the permissible level cause the pollution that alter the quality of water. Other these, the excess material or heat to water also very harmful. The ground water is polluted due to leakage of liquids from the production, process, storage equipment or pipelines to the ground. Huge amount of water is used in the processing of petroleum. Inside the refinery, most of polluted water is recycled. But the large quantities of chemicals are used in different technologies such as water treatment, processing of fractions, as additives to finished products in the petroleum processing are known as associated wastes.

Impact on Health

Water contamination, dust and other air emission, noise, soil contamination and stress (those living near the industrial areas) cause the health issues. There are some hazardous effects due to the petrochemical industry. Noise pollution is one of the hazardous effects. Noise pollution is produced with the feeling of headache, annoyance, uneasiness, stress, impatience, displeasure, hypersensitivity, extreme anxiety, anger, endangerment and violence. The biodiversity and destruction of ecosystems is also a result of petrochemical industry. Toxic products which are present in the effluents in the water bodies pollute the

water that kill the aquatic and human life because of the lack in the purification systems.

The petrochemical can be exposure in various ways: Absorption through the skin and Ingestion. After the accumulation in the body's tissue/organs, they cause brain, nerve and liver damage, birth defects, cancer, asthma and hormonal disorders. The chronic effects of petrochemicals exposure produce skin irritation, ulcers, and allergic dermatitis.

Review of Literature

Ngene *et al* (2016) stated that crude oil and natural gas are used for the energy and raw material. The crude oil and natural gas can be produced at very minimal cost to the environment, trying by the industry. In developing countries, this crude oil and natural gas production give the economic benefits for the both country and citizens. But there is a need to sustain the environment by producing the oil and natural gas that is environment friendly and healthy to public.

Chen, Lin and Chan (2014) Analyzed that chemical substances are emitted from the petrochemical industries and give adverse effects on health. In East Asia, the petrochemical industries is one of the fastest growing field for the development in economy. It gives the huge benefits to the players as well as to the nation's economic growth.

Uzoekwe and Oghosanine (2011) studied the effects of treated effluent discharge on the quality of water of Ubeji Creek, Warri and stated that the improvement has been done in the treatment of Warri Refinery and Petrochemical effluent. According to them, other pollution sources rather than the refinery effluents can be responsible in elevating the levels of physiochemical parameters. They suggested that there is a need of continuous monitoring of surface water in the rural community with high industrial activities.

Sharma *et al* (2017) concluded that a vital role is played by the petrochemical industries in various manufacturing areas. The concern for the societies has been raised because of the environmental hazards. Large amount of toxic and deleterious substances are released by the industries into the atmosphere and harm to health. By the use of environmental and technological developments with the awareness, there is a decrement in the emission of harmful substances. The development of control and preventive measures is necessary that should be taken at the planning stages in these industries.

Ghobadi *et al* (2015) Stated by the studies of development projects of petrochemical industry that the importance and values of natural resources and environment has been buried from the decision

maker's perspective. Without considering the environmental issues, many projects have been made due to which severe pollution such as soil pollution, water pollution and air pollution and degradation of environmental resources issues generated. Land use, increased noise, disruption in transportation patterns and weather change also the negative effects due to the petrochemical industries. In the end of the paper, they suggested that for reducing the negative effects, both remedial and mitigation plans should be used. Corrective measures and improvement programs are enable to reduce the negative impacts of petrochemical industry on the environment.

Ragothaman and Anaderson (2017) proposed that air quality is affected by the refineries and petrochemical industries. These industries release various pollutants into air such as Volatile Organic Compounds (VOCs), Particulate matter, Greenhouse gases, contribute to ozone formation and so on. By exposure of poor quality air, the health conditions adverse and result in the form of death by COPD (Chronic Obstructive Pulmonary Disease), respiratory infection, lung cancer, and heart damage. The health effects due to petrochemical emissions cannot be determined because of the population lifestyle and habits. For improving the air quality, new legislation and policies should be improved by using the statistical modeling. The analysis of distributional consequence of different scenarios can be possible by statistical modeling for the reduction of emission.

Olajire (2014) concluded that many types of wastes and emission are generated by the petrochemical industries that give direct and indirect effects on the environment, and health of the humans. There is a need of the adoption of measures by the sector that can provide a reasonable degree of protection to the environment. In this paper, they also discussed about the techniques for the improvement in the petroleum industry and the energy efficiency consumption.

Conclusion

Petrochemical Industries have an importance in the development of the economy of the country. From the study, these paper concluded that according to rule, the economy and health are correlated to each other. One side, petrochemical industry have positive impact on the economy while on the another side, the health of living being is affected by these industries. The toxic chemical compounds are released from these industries and accumulate in the soil, water and air. By the exposure of water, air and agricultural products, different types of health problems are generated such as cancer, liver and kidney problems and so on. There is need to develop the policies and programs for monitoring and controlling the activities of industries. And for the protection of environment, better education and training should be provided to the industry's personnel.

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