CHEMICAL ENVIRONMENTAL POLLUTIONS: CAUSES AND EFFECTS

Abdallah Alshhab[1*], Nawal Okour[2]

Abstract
This paper aims at investigating chemical pollutions in various ecosystems. For achieving the aim of this study, the researchers follow the "Content Analysis" method by analyzing a book titled: "Sampling and Analysis of Environmental Chemical Pollutants" by Emma Popek , 2018. They focus on two main areas of chemical pollutions that strongly affect environment and its beings. The first is on bringing about the effect of chemical pollutions in environment and humans. The second clarifies the causes of chemical environmental pollution related to non-renewable resource usage. In the light of study's analysis, the recommendations accompanied by suggestions for future research. Finally, the conclusion offers insights depending in the study's discussion.

Keywords: Chemical Pollutions, Environment, Effects of Pollution, Causes of Pollution. Sustainable Development (SD).

[1*]Assistant-Professor, Department of chemistry, Eastern Mediterranean University (EMU), abd82j@yahoo.com
[2]PhD in Environment and Development, Institute For Environment And Development, (LESTARY), National University Malaysia (UKM), okornawal@yahoo.com

***Corresponding Author:** Abdallah Alshhab
*Assistant-Professor, Department of chemistry, Eastern Mediterranean University (EMU), abd82j@yahoo.com

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1. Introduction and Background

Okour (2014) states that man lives in three environments such as; vital, man-made, and social. These environments interact with each other. The environment, as a functional system, has communal relations between its organic and non-organic components. They concluded that the fulfillment of environmental responsibility may sacrifice certain economic benefits in the short term, but it guarantees sustainable development in the long term. In addition, it has inputs and outputs that afford it ability for self-recuperation from any small damage so that the ecosystem can remain stable.

Graafland and de Bakker (2021) concluded that fulfilling corporate environmental responsibility has become a hard standard from a soft constraint, as social forces from all sides are highly concerned, and active environmental responsibility has become an opportunity and goal for cooperating development and stability. Okour (2014) indicates that stability needs a dynamic balance between environmental inputs and outputs. Man, as a living creature, must depend on various resources for his sustenance- light, food, water, shelter and air. These place a fair, but not excessive, demand on the environment. Corporate fulfillment of environmental responsibility is a direct form of positive corporate attitude towards environmental protection issues. Companies willing to take the initiative in environmental responsibility usually have an advantage in achieving sustainable development (Huk and Kurowski, 2021). However, the improvement in standard of living, brought about mainly by industrialization, has placed untenable demands on the environment, such that the ecological balance cannot be restored unless the demands are reined in.

Previously, Okour (2014) says that man has finally recognized the damage he has wrought by his insatiability and carelessness. This damage is represented by several kinds of problems at the national and international levels that have been taken a global character as environmental issues, .e.g., land degradation, overexploiting of surface and underground water, deforestation, water and air pollution, and the depletion of ozone layers.

As a researcher and expert in environmental ethics, Nawal Okour -as one of the two researchers have done this study-says that humans

are exposed to various chemicals in their environment. A wide range of scientific information is now available on the short-term effects of exposure to high levels of hazardous chemicals. However, little is known what happens to individuals who are exposed to very low concentrations of these chemicals after 02 or 12 years. The impact of exposure to a chemical pollutant depends on the length and severity of exposure and the type of chemical to which an individual is exposed.

Klemke-Pitek and Majchrzak (2022) say that the distinction should be made between two main types of exposure: the first is exposure to unusually high levels of pollutants such as accidental chemical releases and occupational exposures or in the case of abnormal environmental accidents such as water pollution incidents. This underpinned by Diamastuti *et al.* (2021) who indicate that chemical pollution is known as chemicals in their gaseous, liquid and solid conditions that are effective, toxic, explosive or corrosive or other characteristics that can result in a risk to the environment and public health whether they are alone or when connected to snore substances. They continue that there is no doubt that the industry is one of the most important sources of chemical pollutants in today's world due to the multiplicity of industries and the tremendous progress in the industrial application of modern science, which is known as technology and is considered the most chemical pollutants produced by the industry have the ability to accumulate in the body of living organisms until they reach the degree of toxicity.

Nassani *et al.* (2022) point out; the increasingly frequent natural disasters happening have forced man to change his attitude towards the environment. In his progress and development, man has, by both commission and omission greatly laid the environment to waste. In his wake, the problems mainly caused by the increasing use of technology in various aspects of life. The new technologies are continually being introduced, causing much anguish and hysteria over environmental issues. They continue that leading as environmental polluters and enterprises should take responsibility for environmental protection.

Diamastuti *et al.* (2021) highlight an annual increase in chemical pollution caused by diverse chemicals in both peacetime and wartime contexts. Toxic chemicals are categorized based on their applications, including pesticides, plant-related chemicals, drugs, hazardous substances used for explosives, alcohol, and more, chemical pollutants can also be classified by their state (solid, liquid, gas) or source (industrial, natural, etc.).

Popek (2018) says that samples of chemical pollution include the catastrophic water pollution caused by crude oil. This oil has lethal effects on seabirds, preventing them from floating and leading to the death of numerous bird species. The use of chemical detergents to clean up oil spills has turned into a toxic pesticide for certain marine microorganisms, especially those on coastal rocks. Irrigation and agricultural water can carry mineral salts and agricultural chemicals into nearby water bodies, posing risks such as elevated nitrated and pollutants.
Smith et al. (2022) highlight the widespread impact of chemical pollution, particularly from pesticides used on treated lands. The effects of chemical pollution are varied and numerous, with many instances demonstrating their negative consequences. Traditional occupational diseases have decreased in developed countries due to stringent preventive measures. However, in developing countries, these diseases are increasing due to inadequate protective regulations, lack of worker awareness, and insufficient cooperation.

In our opinion, to cope with the issue of environmental damage, enterprises, as essential participants in protecting the environment, should increase their investment in environmental protection and actively assume environmental responsibility while developing their economies.

2. Methodology

To help in conducting this study, the researchers adopt "Content Analysis" method, the researchers analyze the book titled: "Sampling and Analysis of Environmental Chemical Pollutants" by Emma Popek, 2018. In addition to the researches that were dealt with in this study. The researchers read the book carefully, followed by writing the sentences related to the subject of study separately for discussion. Ideas that are close in meaning have been addressed and recorded for embracing in the research. The researchers deal with the effects and the causes of environmental chemical pollution.

3. Results and discussions

Chemical pollution is considered one of the most dangerous types of pollution sought by man, where chemical pollution spread in every corner of the planet, and increased the incidence of large accidents related to toxic chemicals, and became

the threat of chemicals surrounds us from every hunched and sound and now threatens our lives. In addition to destroying our environment, causing a lot of serious diseases and loss of shelter.

Chemicals have become commonly used and serve many fields, whether in the medical, agricultural, industrial, construction or other fields, but they currently pose a threat to human life and even humanity as a whole, as nearly a million people lose their lives or suffer serious disabilities annually as a result of exposure to toxic chemicals, which currently number 88 million known chemicals.

First: The Effects of Chemical Pollutions

The researchers of this paper summarized these effects and their impacts from various sources such as (Emma Popek's book, 2018; Diamastuti *et al*, 2021; Smith *et al*; 2022, Nassani *et al*, 2022; Johnson *et al*, 2021) as follows:

1. Air-related incidents, like the London fog, have been extensively documented. Children and the elderly, particularly those with respiratory or circulatory issues, were most severely affected.
2. Individuals are exposed to contaminated substances through various routes, including inhalation or consumption of air, water, food, or soil.
3. Smoking and sulfur oxides contribute to a higher cancer incidence. Health effects include carbon monoxide, trisophilia, and recombinant sulfur oxides from fine particles and lead present in the surrounding air.
4. Recent epidemiological research highlights that indoor air pollution, particularly exposure to radon gas and indoor smoke, has been associated with an elevated risk of cancer. In rural regions of developing countries, exposure to emissions from biomass fuels can lead to heightened rates of respiratory diseases and cancer.
5. Nitrates present a health risk, especially to children. The United Nations Environment Program has been working since the early 1970s to establish health standards for pollutants due to concerns over increased nitrate levels in groundwater across many countries.
6. A consensus has emerged that approximately 12 percent of all cancer cases result from broad environmental factors, including ionizing radiation and carcinogenic chemicals found in air, food, tobacco smoke, alcohol, and drugs (international chemical agents). Although the causes of various types of cancer differ, smoking, including exposure to secondhand smoke, is the primary cause of lung cancer. Paradoxically, the use of tobacco has risen by around 0.2 percent over the past two decades, with an alarming increase in smoking among young individuals.
7. Chemical pollution impacts aquatic ecosystems by affecting biological entities such as plants, animals, microorganisms, and aquatic organisms. Different forms and types of chemical pollutants influence the growth, reproduction, and distribution of aquatic organisms.
8. Chemical pollution can introduce new elements to aquatic environments, contributing to the spread of biological pollution involving microorganisms and aquatic plants. For instance, excessive phosphate and nitrogen compounds can trigger overgrowth of aquatic algae, potentially leading to the degradation of rivers and lakes and disrupting the ecosystem.
9. Biological pollution, in turn, can introduce chemical toxins and harmful elements produced by microorganisms, particularly certain types of algae. These accumulated elements contribute to environmental disturbances in aquatic ecosystems.
10. Chemical pollution can impede water bodies' self-purification processes, causing pollutant accumulation and accelerating the growth of aquatic organisms. This can escalate to significant biological pollution in these environments.
11. Organic chemical pollutants can enhance the proliferation of both pathogenic and non-pathogenic microorganisms. Biodegradable organic compounds serve as carbon sources for these microorganisms, potentially leading to biological pollution in aquatic environments where chemical pollutants are present.

In cases of initial exposure, the effects of chemical pollution are evident, including immediate death, premature death, or heightened morbidity. The Bhopal accident's accidental release of methyl isocyanate led to direct fatalities and a surge in illnesses.

Exposure to high chemical concentrations is linked to various occupational diseases. Examples of such effects include:

- lead poisoning
- lung change (lung diseases caused by dust inhalation)
- Poisoning with pesticides and various cancers.

Second: Causes of Chemical Pollution:

Backhaus, *et al. (*2018) indicate that human life began on Earth with a focus on survival against

natural elements like wind, rain, temperature variations, and predatory threats. Over time, humans strived to secure basic necessities such as food, shelter, and protection. As millennia passed, human development progressed, leading to innovations and technological advancements that shaped modern society.

During research on chemical pollution, investigators discovered numerous endeavors over the past two decades to assess the health repercussions of human exposure. These efforts involve utilizing models to compute the environmental dispersion, transmission, and destiny of harmful chemicals. Researchers also analyze human exposure through different pathways and assess the toxicity of chemicals and medications. The outcomes of these studies are anticipated to aid nations in evaluating cumulative risks associated with pollutants in air, food, and water, thereby facilitating the implementation of suitable measures to safeguard human well-being.

Schymanski and Williams (2017) say that human-induced environmental pollution arises from a broad spectrum of sources, encompassing biological pollution, radioactive pollution, nuclear pollution, chemical pollution, and other atypical forms. These pollutants have exerted their influence on various environmental components, spanning terrestrial, aquatic, and atmospheric domains. This impact extends to both ecosystems and living organisms, including humans, resulting in consequences for health and the environment. The researchers proceed to elaborate on the causes of chemical pollution as follows:

a. Industry and Growth

Gago-Ferrero, *et al*. (2018) indicate that most industries in the world produce huge quantities of chemicals polluting the environment, and despite the fact that most factories in the world follow special methods to treat these chemical wastes, however, huge quantities of these dangerous substances still find their way into the environment without treatment and thus cause a clear environmental imbalance. The following-as our viewpoints- are considered the main causes of chemical pollution under the umbrella of industrial affairs:

Petrochemical industry:

Singh, *et al.* (2014) signify that the petrochemical industry was rooted on oil refining and natural gas exploitation. It encompasses various products like agricultural pesticides, plastics, synthetic fibers, medicines, chemical compounds, disinfectants, paints and explosives. This industry is a significant contributor to chemical pollution. They continue that advancements in polymer and plastic technology have led to the emergence of the plastic industry, which has replaced metals in various applications. While some waste, including water used in manufacturing and cooling, is released into the sea, these companies employ advanced systems and precautions for water treatment, minimizing pollution risks in many cases.

Chemical Fertilizer Industry:

The companies in the petrochemical industry produce ammonia and urea fertilizer compound, which generate urea dust as an environmental issue. Undeman, *et al.* (2012) say that to address this, companies are implementing systems, which filter to reduce waste emissions. Mercury emissions from fluid substances that evaporate at high temperatures have polluted the air. Studies prompted a shift away from mercury-based manufacturing, resulting in process modifications and the cessation of mercury discharge into seawater. Moreover, the salt and chlorine plants, dependent in seawater for sodium chloride productions, underwent changes. Another source of pollution emerged during the construction of oil sector complex. In agriculture, the extensive use of pesticides, herbicides, and chemical fertilizers has led to pollution of farm lands. Chemical fertilizer can infiltrate groundwater and water bodies, disrupting ecosystems by eliminating organisms or promoting excessive algae and wood growth.

Urbanization Impact on Pollution:

Ahmed& Streimikiene (2021) say that the growth of urban population and increased living standards has given rise to hazardous substances that pose a threat due to their toxicity. These substances, when present on high concentrations in water and soil, can harm and eliminate living organisms. Furthermore, these pollutants persist in the environment for extended periods.

Transportation:

Chang, *et al.* (2020) indicate that transportation activities contribute to environmental pollution by emitting harmful gases. Car emissions, for instance, contain carbon oxides, sulfur, and nitrogen compounds, along with unburned hydrocarbons. Various modes of transportation also release toxic compounds and heavy elements, including lead, exacerbating pollution concerns.

Acid rain:

Acid rain as Dürig, *et al.* (2019) have written, is a destructive consequence of air pollution, stemming from the conversion of acid gases emitted by power stations and industrial centers, which burn fuels and release substances like sulfur dioxide, hydrogen sulfide, and nitrogen oxide into the atmosphere. Nitrogen oxides, produced by fuel combustion in factories and vehicles, further contribute to acid rain when they react with atmospheric oxygen and ultraviolet rays, forming nitric acid that combines with rainwater, similar to sulfuric acid. Acid rain poses several dangers, including:

- Soil Contamination, acid rain dissolves heavy metals from soil and transports them to lakes, harming aquatic organisms.
- Widespread Impact isn't confined to urban areas with factories and transportation; it also affects various far regions.

b. Pollution from Oil Sector:

The oil sector, driven by lucrative oil exports, yields significant financial gains and supports essential services like health, education, and housing. Crude oil is a valuable resource, yielding diverse products like natural gas, gasoline, diesel, and chemicals through refining and petrochemical processes.

Reppas-Chrysovitsinos, *et al.* (2018) have said that chemical pollution spans seven distinct sectors: oil, industry, energy, waste, transport, agriculture, and war. Each sector contributes to pollution in various ways. Pollution occurs chemically in multiple ways. First, during constructions and operations, pollutants are released. Second, pipeline networks, under water pressure, can potentially leak chemicals into the sea. Third, oil fields' seawater injection projects require treatment to meet specifications for injecting water into oil reservoirs, safeguarding their integrity. Oil pollution is the causes of the following:

Ozone Depletion

These pollution sources are part of a broader concern about ozone depletion and its environmental consequences. It is resulting from the field of industry that affects strongly the ozone layer, a protective shield in the upper atmosphere. Ozone forms when oxygen reacts with ultraviolet rays, absorbing harmful UV radiation. Human activities, particularly in developed nations, have led to ozone layer depletion, especially over the poles. Reasons for the ozone gap include harmful atomizers, jet flights, and space rocket launches. These activities weaken the protective shield against destructive UV rays, endangering life on Earth(Taylor *et al.*, 2018).

Oil Pollution on Marine Environment:

Effects are significant, particularly in marine environments, Yin, *et al.* (2017) continue that oil contains hydrocarbons and toxic carcinogenic compounds. When oil is spilled, it forms a layer on water's surface, hindering gas exchange between water and air, reducing oxygen dissolution, and harming aquatic life. The marine environment is impacted by the use of seawater for cooling and evaporation in power plants, affecting water quality due to chemical pollution. (Dabhi, 2019) indicates that the natural gas desalination unit, designed to remove bacteria from natural gas, discharges cooling water into the sea containing potentially harmful chemicals. In addition, oil tanker and ship accidents contribute to pollution. On the other hand, thermal pollution arises from high cooling water temperatures, although recycling processes are closely monitored to prevent untreated releases into the sea. Fuel combustion produces gases with sulfur and carbon compounds, causing pollution and environmental harm.

4. Recommendation and Suggestions

In the light of the previous discussion of this study, it is recommended the follows:

- Efforts should be adopted by developed and developing countries to reduce chemical pollution that threatens the environment and its ecosystems.
- Sustainable Development (SD) could be taken into account as an actual movement for effectively planning development along with conservation.
- Scientist and researchers must go on doing more researches on committing awareness regarding the effects and causes of chemical pollution.

5. Conclusion

In sum, it is concluded, chemical pollution is a dangerous natural disaster that threatens the environment and its ecosystems. The objective of the study is achieved by the method of analyzing content, followed by discussing the impacts and causes of chemical pollution that powerfully affect the environment. The researchers sum eleven effects of chemical pollutions in environment and humans, on the other hand, the causes of chemical pollution are represented by two main topics, e.g., industry and growth, and pollution of oil sector. From what has been discussed, it is clear that to be environmentally sound, we should deal with SD as a strategy that could reconcile between the three

scopes; economics, environment, and the society, and so all lives will be salvaged from dangerous situation. Moreover, efforts are to be made to adhere to safety standards to minimize hazardous chemical pollution. Contentiously, under this risky state that had to be curbed chaos of chemicals and put the controls, standards and recommendations to protect and preserve the environment should be set up, so, human health will be safely protected. Ending this conclusion, it is hoped that this study has made even at least a small contribution to knowledge.

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