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Pollution of Water from Urban, Agricultural and Industrial Effluent: A Review

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Abstract: Currently, water resources are becoming increasingly limited, and many are contaminated by human causes such as industrial waste, agricultural waste, and domestic waste. As a result, wastewater treatment is still required before it may be discharged into natural water sources. The primary goal of wastewater treatment is to eliminate impurities such as suspended particles, organic carbon, nutrients, inorganic salts, heavy metals, pathogens, and other toxins found in wastewater. Wastewater treatment's main purpose is to safeguard human health and the environment. In this review, the most prevalent contaminant from urban, agricultural, and industrial effluents have been outlined to assist in selecting the most effective ways to adequately treat the various types of wastewater.

Keywords: Industrial Waste, Agricultural Waste, Domestic Waste, Wastewater

1. Introduction

One of the most important challenges facing humanity today is to conserve and sustain natural resources, including water, in order to increase economic and social development along with

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environmental protection [1, 2]. Effluents from the urban and industrial sectors give large harmful impacts on living organisms due to chronic toxicity. Pollution happens caused by various activities due to the urbanization process and rapid development of the industrial industry [3]. Methods to prevent, minimize and overcome this pollution should be planned properly by the government to achieve sustainability and eco-friendly development.

Water pollution (or aquatic pollution) is the contamination of water bodies, usually as a result of human activities, in a way that negatively affects its legitimate uses [4]. Water pollution also can be defined as a change that occurs to the water bodies in terms of content or color as well as chemical properties caused by various pollutants in various forms such as solids, liquids, and gases. Furthermore, it also can be classified as surface water pollution or groundwater pollution. The water bodies that have been discussed include for example oceans, lakes, reservoirs, aquifers, groundwater, and rivers. Many cases have been recorded, that water pollution is mostly caused by the discharge of sewage into the water bodies without adequate treatment which will reduce the ability of water bodies to provide ecosystem services that it would otherwise be provided [5]. Additionally, water pollution can destroy aquatic ecosystems which in turn can pose a risk to the extinction of an aquatic species [6]. In addition, this pollution can also lead to public health problems such as water-borne diseases for people who use water from the natural resources as one of their living needs as well as can affect the use of other water, such as irrigation activities [7, 8].

The entire biosphere of plants and organisms that live in the body of water could be affected too, as well as organisms and plants that are exposed to its water [9]. The effects can be devastating not only to individual species but also to natural biological communities. Sources of water pollution can be grouped in several points, such as point sources, non-point sources (permeable), and groundwater pollution. Storm drain or wastewater treatment plants are the example of the point sources while agricultural runoff which is more diffuse is the example of the non-point sources [10]. Among the pollutants that can contribute to water, pollution includes a wide spectrum of chemicals, pathogens, and physical changes such as high temperatures.

Water pollution traditionally can be categorized into four sources, namely sewage, agriculture, industry, and urban. There are about 785 million people in the world who do not have access to clean drinking water due to pollution although supplying clean drinking water is an important ecosystem service that has been provided by several freshwater systems [11]. Water pollution measurement can be carried out by analyzing water samples with physical, chemical, and biological tests. To supply clean and quality water to future generations, water pollution control must be implemented immediately to prevent the current scenario from getting worse [12]. This can be achieved by treatment of wastewater appropriate to the situation, providing safely operated sanitation services for people without access, treatment of agricultural wastewater, erosion and sediment control from construction sites, and controlling urban runoff (rainwater).

In this paper, we presented a categorization of a water contaminant. We also discussed water contamination caused by urban, agricultural, and industrial effluent. Furthermore, the current review focused on wastewater management.

2. Classification Of Water Pollutant

2.1 Organic Pollutants

Organic compounds commonly contain carbon and other elements such as hydrogen, oxygen, nitrogen, sulfur, and others [13]. These matter naturally reacted water and all these elements are organic compounds and known as contaminants in the aquatic system. In addition, these elements also can divide into two types which are dissolved and particulate organic matter depending on the originality and solubility of those elements [14]. Other than that, three types of organic pollutants are

oxygen demanding contaminants, synthetic contaminants, and also crude oil, and various petroleum products. These water pollutants can be detected by doing the test of BOD on that area affected [7].

2.2 Inorganic Pollutants

Non-biodegradable pollutants were classified under inorganic pollutants because their material cannot decompose easily in a short period. Moreover, inorganic pollutants have two types of nutrients and toxic compounds [15]. In nutrients, categories have cations and anions elements. Then, toxic compounds have three categories gases, anions, and heavy metals elements [16]. This element if too excess will be harmful to humans or all living things to consume it.

2.3 Suspended Solids and Sediments

Suspended solids and sediments normally happen when any industrial waste or any substances that commonly these suspended solid will covered the surface of the water and block the sunlight to penetrate in the water [17]. These substances were very dangerous to aquatic life, especially for the vegetation photosynthesis process. This occurs when we found a blooming area at water resources [18].

3. Urban Pollution

Urban pollution is defined as the presence of new cities developed in the urban concept that will harm human health and of course, will decrease the living things' habitat. Most substances even poisonous and harmful substances secrete from the urban area. The anthropogenic sources of pollution, such as factories, industries, transportation, and so on, are typically exacerbated in cities due to the local concentration of humans and human activities [19]. More than that, urban pollution also affected the environmental thread for example global warming, and also a lot of challenges to be done such as waste management, recycling, and light or noise generation. Within urban pollution was categorized into a few types of pollution which are air pollution, water/freshwater, marine, and coastal pollution, soil and land pollution, water pollution, and also noise pollution.

3.1 Air Pollution

A lot of activities contribute to air pollution issues for example manufacturing factories, open burning activities, vehicles, and also the density of the human population. Regarding the air pollutants, there are two large groups depending on their provenance. Primary pollutants are those that are directly emitted into the atmosphere (carbon monoxide or sulfur dioxide), and secondary pollutants, such as ozone, are formed because of chemical reactions between other pollutants and atmospheric gases [20]. In addition, excess nitrogen oxide in the air also causes ozone depletion and surely increasing of global temperature and towards global warming then a lot of melting of ice will happen. Then, the ocean water level will increase and a lot of floods happen around the world. When NO_2 interacts with water, oxygen, and other chemicals, it causes acid rain and hazy air, which can harm lakes, forests, natural parks, and coastal waters [21].

3.2 Water/Freshwater, Marine, and Coastal Pollution

Increasing populations in cities, of course, need a lot of water consumption. Most of the human demand in freshwater is mostly groundwater resource but it has limitations. Commonly we found these freshwater resources at rivers, reservoirs, and also lakes [22]. These freshwater resources must be kept in healthy conditions for humans as for drinking water. If the resources are polluted surely very dangerous to those who consume them either humans or animals. The chemicals substances contaminated will react on human body cells and also undergoes the mutation that might be a lot of cancer disease happen [23, 24]. Not only for freshwater but marine water is also very important to keep them safe. Aquatic life in the ocean needs clean and healthy water conditions without any pollution to stay alive [25]. Including coastal population as an indicator for health ocean quality. Coastal was very

sensitive and fishes or any living thing around it were also very sensitive with polluted water that caused died [26].

3.3 Soil and Land Pollution

Soil and land urban pollution can be caused by natural sources (soil geochemistry, geology, salt, landslides) or by anthropogenic sources (land-based farming, industry, extractives, waste, waste-water, transport, energy production). Urban soil degradation will increase when soil sealing happens due to the impermeable material covering the soil surface. In addition, soil erosion might be an effect on freshwater quality [27]. Moreover, desertification and soil acidification is caused by acidifying air pollutants deposited on the soil surface [28]. Moreover, soil pollution will threaten soil biodiversity which animals or plants cannot survive so it will cause fewer soil nutrients than the soil will be contaminated [29].

3.4 Waste Pollutions

The increasing industrial activities and also human population will produce a lot of solid waste. There are different types of wastes: food waste, commercial and industrial waste, construction and demolition waste, agricultural waste, forestry waste, mining waste, and quarrying waste [30]. Disasters contribute to the generation of waste as well. Because of that, a lot of things should be done to overcome these issues. So, a lot of landfills are required to collect this solid waste. Then, of course, deforestation will happen for landfill construction [31]. The ecosystem will be affected when our forests need to be cut down just for human and industrial solid waste. Less green areas will harm the circulation process of gas emission either absorption of carbon dioxide or secretion of oxygen. Within these solid waste will secrete a lot leachate than will absorb into the soil and mix with water and run to nearest water resources. So, the leachate contains a lot of harmful substances which are very dangerous for health but a lot of landfill areas will make it worse and not good [32].

3.5 Noise pollution

Noise pollution happens due to a lot of vehicles and industrial activities for example construction industries including construction projects, mining activities, quarry areas, and timber manufacturing industries. Vehicles sound including public transport, airport, railways, and also normal road traffics. These sounds produced harmful for human or animal health which caused stress and psychological issues. The primary specific health issues related to noise pollution are hearing problems, cardiovascular disease, cognitive impairment, sleep disorders, tinnitus, and annoyance [33].

4. Agricultural Pollution

Agriculture was a natural process that was very important for human food security [34]. Traditional agricultural work does not affect the soil or any water resources around it but modern technology with high usage of chemical fertilizers and pesticides may cause pollution in agricultural fields [35].

4.1 Effects of agricultural pollution

1. Health-related issues which happen due to the widely used of chemical fertilizers and pesticides to the plant may cause groundwater pollution that will be consumed by humans and also animals.

2. Effect on aquatic animals because the fertilizers, ammonia reacted chemically produce sulfate and nitrate which this element will suspend on the surface of the water than the production of algae and reduces the amount of oxygen present in water. Moreover, it will affect a lot of aquatic life and will die because of less amount oxygen level.

3. Eutrophication happens when high of algal blooms. Eutrophication extensively depletes the oxygen in the water which affects aquatic life including the fish and also aquatic biotas.

4. Decrease in crop yields whereby excessive usage of pesticides and fertilizers and combination between agrochemicals control pest will produce large crop yields the soil treated like this will suffer in the long-term.

5. Soil pollution and depletion of fertility because the usage chemical substances and have a positive and negative impact but excessive usage surely will decrease the soil fertility and nutrient in the soil not stable and not suitable for plants.

6. Air pollution is caused by the usage of modern types of machinery in large-scale farming such as tractors, backhoes, and generator machines. These machines mostly use fossil fuel combustion to generate energy, so a lot of carbon dioxide is released and affects air quality than the CO_2 gases will emit with the ozone layer. The depletion of the ozone layer of course will may global warming.

7. Biodiversity loss when an ecosystem is very sensitive to changes but it may cause big effects on the natural ecosystem. The usage of chemical and synthetics products for agriculture will harm animals, plants, and wildlife.

8. Water pollution happened when the agricultural work practice does not have appropriate water management and irrigation process lead to water pollution when runoff water from the vegetation area enter the river or into the ground than change the properties of water.

9. Effects on plants when these chemical substances from chemical fertilizers, pesticides,and synthetics pest control will change the properties of soil. Then, the changes will change the characteristics of the soil and some genetics of the plant cannot counter the changes and will die.

The solutions to be taken to overcome this pollution firstly tighten the rules and regulations by the government. The authority involved in the agricultural field must ensure the farms in clean and follow the environmental aspects to prevent any pollution occurs and secure the environment for the future generation. Then, increase the awareness of farmers on how to save our environment and the whole ecosystem [36]. Enhance awareness of the right quantity and types of fertilizers and pesticides used and use of cover crops to prevent any soil erosion on the surface runoff to water resources [37]. Then, planting grasses, trees, and fences along the edges of the field on the borders of the water body can prevent nutrient loss before reaching the groundwater. In addition, changes in agricultural practice by balancing the modern and traditional practice to balance the demand and environment friendly. Right practice will help secure our environment for our future generations.

5. Industrial Pollution

Industrial pollution originates directly known pollution occurs by the industrial revolution, manufacturing industry and technology improvement nowadays [38]. These factories emit smoke into the air and the smoke affects the quality of air become worse. Then particles released will react with water vapor then produce acid rain. Acid rain will be harmful to human skin and also cause cataracts. Other than that, acid rain also affects vehicles and building paint which will goes discoloration. Furthermore, the acid rain will run off towards water resources then this water will harm aquatic life. In addition, the particles in the smoke will trap heat from the sunlight that caused global warming and the particles reacted with the ozone layer will cause ozone depletion [39].

6. Management of Wastewater

Wastewater is used water with contains humans' waste, soaps, food scraps, oils, and also chemical substances released from residential areas and also industrial companies [40]. Wastewater should undergo treatment or another treatment called sewage treatment. Billions of gallons of wastewater and

sewage produced every day need further treatment before release back to the environment. A lot of treatment plants are built nowadays to reduce pollutants in wastewater to a level nature can handle [41].

The most important wastewater treatment technologies based on adsorption include biological approaches that use bacterial biomass [42-45]or plant biomass [7, 46], as well as chemical approaches that use nanoparticles [47, 48]. **Table 1** lists the top 20 authors in terms of the number of papers on wastewater management. Liu y., on the other hand, published the most articles in 2021, with 55.

Table 1: The top 20 authors with the number of articles about the management of wastewater. Source data from Scopus literature (2021).

Selected	Author	Documents	Citations	Total link strength
☑	liu y.	55	130	50
☑	zhang y.	49	109	49
☑	wang y.	53	133	47
☑	li x.	50	130	45
☑	li y.	49	157	39
☑	wang h.	37	187	35
☑	wang j.	32	79	30
☑	zhang x.	38	65	30
☑	wang z.	42	87	29
☑	li j.	33	94	28
☑	wang x.	32	92	27
☑	zhang l.	32	60	27
☑	liu x.	26	70	26
☑	li z.	22	103	23
☑	chen j.	21	71	22
☑	chen y.	32	103	21
☑	yang y.	22	74	20
☑	li h.	23	82	19
☑	zhang h.	25	83	19
☑	zhang j.	25	41	16

Furthermore, **Table 1** shows the top 20 countries in terms of the number of papers on wastewater management. Scopus literature was used as a source of data (2021). China ranked first in terms of the number of articles published on wastewater management, with 785.

Lack of wastewater treatment will give a negative impact on human health including aquatics life. Within wastewater treatment is mainly purposed to remove as much of the suspended solids as possible before remaining water of effluent discharge back to the environment [49]. Furthermore, the decaying process will increase the usage of oxygen needed by the plants and animals living in the water.

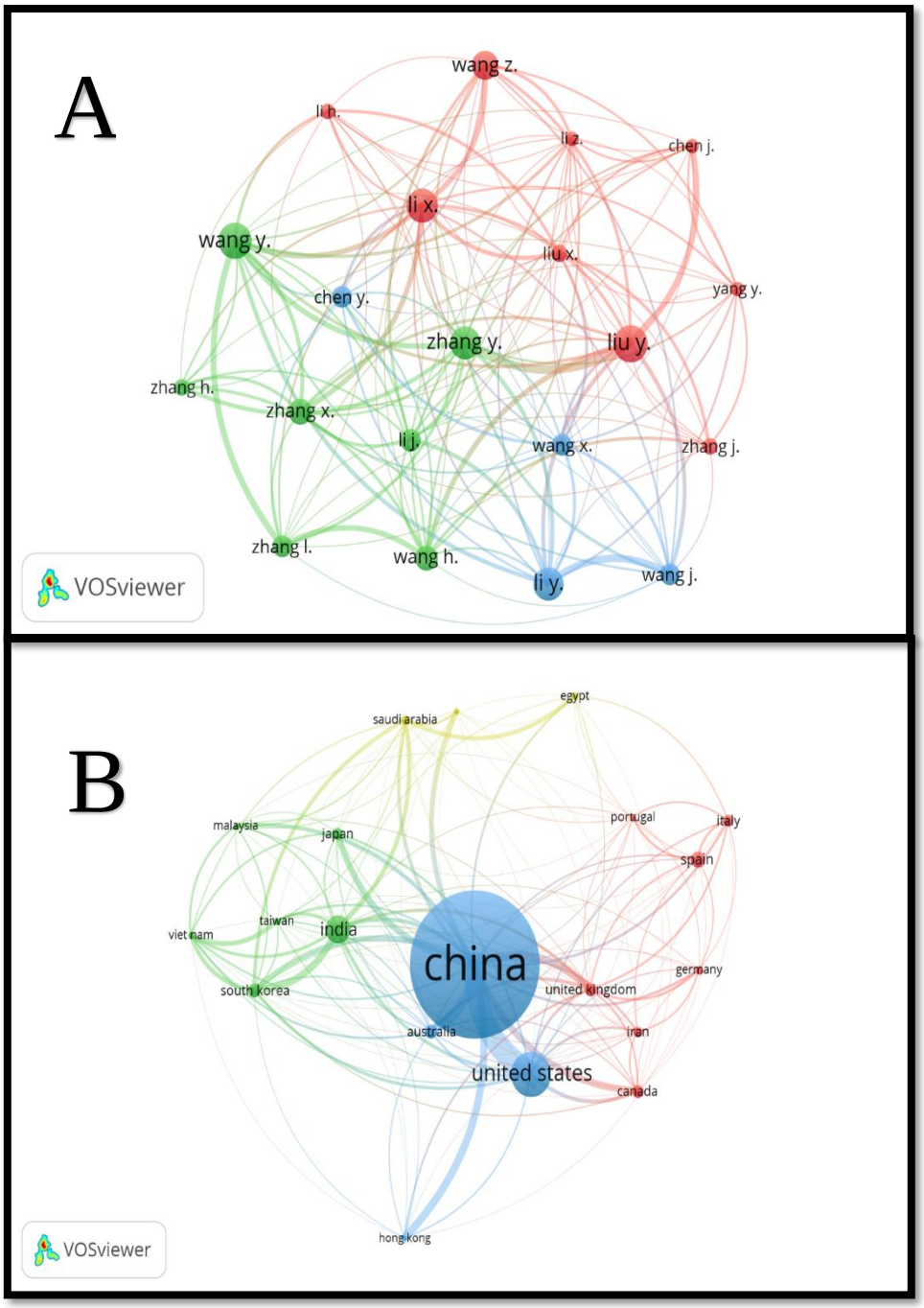

Figure 1: (A) The top 20 Authors with significant numbers of management of wastewater articles. (B) Network of relationships between top 20 countries with the management of wastewater research. Source Data from Scopus literature (2021), generated using VOSviewer

7. Conclusion

A sustainable environment nowadays is very important for future generations. A lot of the organisms depend on healthy water to survive. Polluted water needs a lot of costs to undergo treatment which affected the economy because the tourism sector will lose, fishing activities down, and local real estate values getting low. An aggressive and strategic plan must be endorsed and applied to keep the environment safe. Even though, the important thing to ensure is to define the causes of the pollution occurs. Lack of management process in sewage treatment is also one of the causes of water pollution. While many individuals and communities have long recognized the damage that can be caused to our

environment and that of the plants and animals we share our planet with, it is only relatively recently this has been acknowledged globally.

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