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Study of River Pollution's Effect on Water Quality

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ABSTRACT

In order to control weeds, pests, and diseases in crops as well as for human and animal health, pesticides are a type of chemical that is used all over the world as herbicides, insecticides, fungicides, rodenticides, molluscicides, nematicides, and plant growth regulators. Application of pesticides results in increased crop and food productivity and a significant decrease in diseases carried by vectors. However, the environment in general, as well as the health of people, birds, and other animals in particular, has been seriously concerned by their uncontrolled and indiscriminate applications. The use of some of the least biodegradable and most environmentally persistent pesticides, such as organochlorines, is constantly increasing, despite many countries banning their use. Because of their quick lipid solubility and bioaccumulation in organisms other than their intended targets, pesticides pose serious health risks to living systems. Pesticides may have a number of unfavourable effects, even at low concentrations, which could be observed through biochemical, molecular, or behavioural means. Drainage, rainfall, microbial activity, soil temperature, treatment surface, application rate, solubility, mobility, and half-life of pesticides are some of the variables affecting pesticide and residue water pollution. More than 70% of the pesticides currently used in India are organochlorine insecticides like DDT and HCH. Reports from Delhi, Bhopal, and other cities, as well as some rural areas, have revealed the presence of pesticides at significant levels in fresh water systems and samples of bottled mineral water. This review has covered the effects of pesticide pollution on India's drinking water and riverine systems.

Keywords-- Water Quality, Pesticides, Pollution, River, Control

I. INTRODUCTION

Life is dependent on water. Without it, no living thing on Earth can endure. The majority of the water on Earth is marine water, which must first be processed by humans before it can be used. The only fresh water that is readily accessible and fit for human consumption comes from the ground. However, if it had been of great quality, the volume would have been sufficient to meet the needs of the living things. Because it is necessary to sustain the physiological functions of every biological cell, water quality is significant to our existence.

Water pollution is any alteration of a body of water's natural qualities brought on by anthropogenic contaminants to the point where it is unfit for human consumption or the sustenance of biotic organisms like fish. The term "water pollution" refers to the tainting of bodies of water by human activity, including lakes, rivers, oceans, and groundwater. Every type of water pollution has an impact on the creatures and vegetation that inhabit these bodies of water, and in virtually all instances, this impact is detrimental to both the individual species and populations and the wider natural biological ecosystems. It happens when contaminants are released into bodies of water directly or indirectly without being adequately treated to remove dangerous components.

Given that it causes the onset of several terrible diseases, which claim the lives of over 14,000 people every day, water pollution is a serious source of concern for the entire world. More concerning than the issue facing industrialised countries is the situation in developing nations. Along with pesticides, other natural occurrences like earthquakes, algae blooms, hurricanes, and volcanoes have a significant impact on the biological health of water. There are numerous factors that contribute to water contamination. Toxins alter the quality of water, making it potentially hazardous to certain life forms rather than supporting them.

According to reports, many water contaminants behave like harmful chemicals. The insecticides are not species-specific because they are made with the goal of killing pests and insects in general. They use application techniques that make sure the poisons only hit the intended pests, killing them while avoiding the intended organisms. However, these target pests are merely animal species that exhibit a number of the same traits as other animals. Being vulnerable to specific chemicals is one of these traits. To put it another way, a substance that is poisonous to one species may also be toxic to other animal life. Many pesticides are hazardous to people, even if they may require a higher dose to harm us than pests like insects. Humans are affected by pesticide dosages in different ways, including impairment of sex hormone function and reproductive efficiency. The pesticides are collectively referred to as "endocrine disruptors" because they mimic endogenous hormones' actions or otherwise interfere with endocrine functions.

A substance called an herbicide is applied to unwanted plants. Selective herbicides kill particular targets while largely sparing the targeted crop. Some of these have the effect of preventing weed growth, and many of them are artificial "imitations" of plant hormones. Herbicides are non-selective and destroy all plant material with which they come into contact. They are used to clean waste ground, industrial sites, railways, and railway embankments. Forestry, grazing systems, and management of areas set aside as wildlife habitat all utilise smaller quantities. For the target plant pests, many of them are species-specific. Broad-spectrum herbicides, which are intended to destroy a wide range of plants, are the exceptions to this rule. It does not guarantee that a herbicide is safe to enter the water system if it is specialised for one or more plant species. Some of the risks posed by these substances are still not completely recognised. Therefore, care should be taken to prevent these products from inadvertently getting into the water system. The risk to people and other animals is very low when things like pesticides are applied in a safe, well-thought-out manner. If these items get into the water supply, they can end up reaching non-target species and endangering the lives of non-target plants, humans, and domestic animals. There are numerous substances other than pesticides that have the potential to harm water systems and ultimately people in the same way. The most rational approach to addressing the issue of water pollution could be to make an effort not to intentionally introduce any harmful compounds into waterways because the outcome might be a decline in water quality. The situation is not as dire as it first appears. We must take action to safeguard the quality of our water because the threat to water systems and the processes that lead to water pollution are now well recognised. In the current review, an effort has been made to consolidate and project the most recent information available on this topic with a focus on India, keeping in mind the importance of pesticide pollution in water systems and its impact on humans, animals, and the environment.

II. WATER POLLUTION SOURCES

The polluting of water bodies is known as "water pollution" (e.g., lakes, rivers, oceans, groundwater). This can be explained in terms of the unfavourable modifications to the chemical and physical characteristics of water that do not benefit all living beings that depend on it for survival. Water pollution can take one of two main forms: either changing the kinds and quantities of materials transported by water or changing the physical properties of a body of water. Water pollution comes from a variety of sources and takes many different forms. Water pollution from feedlots, pastures, and croplands may be caused by agriculture. Landfills, oil drilling, and mining might all be significant contributors to water pollution. The sanitary sewer system, storm sewers, business, and construction are additional human-related sources of water pollution.

The Environment Protection Agency (EPA) reported in 1990 that leaching and mixing of chemicals from agricultural operations account for more than 50% of the water contamination in streams and rivers. Municipal sources were in second place with around 12% of the total. Agricultural practises, storage tank leaks, industrial waste, sewer and septic system leaks, leaching from landfills, mining, and many other factors can all cause groundwater contamination (USGS Circular 1998). When a body of water is negatively impacted by the addition of significant volumes of materials to it, it is said to be polluted. Point sources and non-source points of contamination are two different types of sources of water pollution. When a contaminating substance is released directly into a river, it is referred to as a "point source of pollution." An illustration is a conduit that discharges hazardous chemicals into a river. When pollutants are conveyed into a river by surface runoff, such as when fertiliser and pesticides from a field are carried into a stream, this is referred to as a "nonpoint source." Chemical pollutants that do not naturally occur in aquatic ecosystems are referred to as "harmful substances." Herbicides, pesticides, and industrial chemicals are the biggest causes of harmful contamination.

Pesticides are those substances (insecticides, fungicides, herbicides, rodenticides, molluscicides, nematocides, plant growth regulators, etc.) that have been widely used around the world to boost crop yields and eliminate the insect pests that are responsible for spreading various diseases to people and animals. But many publications say that it has been proven that these compounds are bad for the environment and for living things' health.

Organochlorine (OC) insecticides, which were used to successfully control a number of diseases like malaria and typhus, have been prohibited or limited in the majority of technologically sophisticated nations. After 1960, many health management programmes as well as agricultural techniques began to use other synthetic insecticides such as organophosphate (OP), carbamates, and pyrethroidsogically sophisticated nations. After 1960, many health management programmes as well as agricultural techniques began to use other synthetic insecticides such as organophosphate (OP), carbamates, and pyrethroids. After 1960, many health management programmes as well as agricultural techniques began to use other synthetic insecticides such as organophosphate (OP), carbamates, pyrethroids, herbicides, and fungicides. Figure 1 presents an illustration of the pesticide cycle.

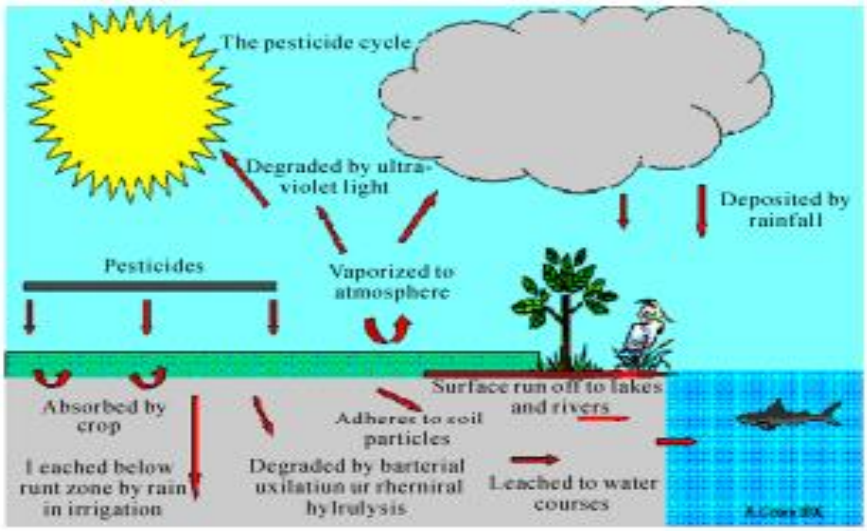

Figure 1: A diagram illustrating the many phases of the pesticide cycle

Environment, more than half of pesticides are used in homes and gardens, in and near schools, businesses, hospitals, and other structures, by both urban and rural farmers alike.

A pesticide is a substance that should only kill the bugs it is intended to kill, not non-target living things like people and animals. However, the overuse of these substances has had a negative impact on the ecosystem's flora and fauna. The Indian Council of Agricultural Research (ICAR) formed a committee to recommend potential solutions to counteract the toxicity caused by the presence of pesticides and their residues in consumables after nearly 100 individuals in India died after consuming wheat flour tainted with parathion. By examining the toxicity of OC chemicals and their metabolites in birds, the US National Academy of Sciences studies supported the initial warning concerning the poisoning of biological systems by organochlorines (OC). It has been established that the pesticides manifest their effects by inducing xenotoxicity, changes in immune function, reproductive function, and other physiological processes in many organisms, leading to the development of several diseases, including cancer.

III. CONCERNS REGARDING WATER QUALITY

Humans that drink water from polluted wells are exposed to pesticide and fertiliser residues. Infant methemoglobinemia, a disorder in which nitrates are converted into nitrites in the digestive system and interfere with infants' blood's ability to carry oxygen, is a recognised human health danger from nitrate exposure. Some experts also believe that nitrates are carcinogenic (cancer-causing). There may not be any acute health impacts from the concentration of nitrates or pesticides in drinking water. The impacts of persistent exposure, however, could affect people or other creatures in the form of cancer, reproductive issues, etc. It is unclear to what extent drinking water with residues of pesticides or nitrates at levels where human health could be threatened poses a health concern.

Because some pesticides are thought to be carcinogenic in high quantities, the Environmental Protection Agency (EPA) of the United States has established health standards establishing the maximum permissible contamination levels for 26 pesticides. Resurfacing contaminated groundwater has an impact on non-targeted flora, birds, or aquatic species in the environment, some of which are endangered. The percentage of pollution coming from point sources, like sewage treatment plant outputs or industrial sources, seems to be declining as a result of several years of control measures. The EPA says that non-point source contamination from agricultural tillage, pesticide use, and urban development is the main reason why surface water is getting worse today.

With 58 percent of contaminated lake acres and 55 percent of impaired river miles, as determined by the States in 1986 and 1987, agricultural runoff is the single largest source of surface water contamination. It was determined in recent research by the USDA's Economic Research Service (ERS) how much agricultural runoff contributed to the supply of nutrients and sediments to lakes and streams. 48 of the 99 watersheds that were analysed had high levels of silt or nutrients. According to the study, nitrogen from agriculture is a "significant source" (defined as generating more than 50% of pollutant flow) in nine watersheds. 34 watersheds had major

agricultural sources of silt. Significant agricultural phosphorus runoff was present in 31 basins. A different ERS study that was conducted recently outlined the magnitude and importance of agricultural impacts on coastal water pollution. A typical 24 percent of all nutrients and 40 percent of all sediment in the 78 estuary systems studied came from agricultural runoff. In 22 of the 78 estuaries, agriculture was responsible for more than 25% of all nutrient input. In 21 systems, high rates of pesticide losses to surface waters were discovered. 15 estuary systems revealed both considerable pesticide losses and significant agricultural nutrients.

Agricultural chemicals' impact on the nation's groundwater resources is less well understood. The notion that groundwater was shielded from agricultural chemicals by impervious layers of rock, soil, and clay was debunked by the discovery of chemical residuals in groundwater in the late 1970s and early 1980s. Other factors, such as the use of pesticides and fertilisers in non-agricultural settings and leaking underground storage tanks, can also contaminate groundwater.

IV. RIVER WATER POLLUTION

Most of the Indian rivers and their tributaries viz., Ganges, Yamuna, Godavari, Krishna, Sone, Cauvery Damodar and Brahmaputra are reported to be grossly polluted due to discharge of untreated sewage disposal and industrial effluents directly into the rivers. These wastes usually contain a wide variety of organic and inorganic pollutants including solvents, oils, grease, plastics, plasticizers, phenols, heavy metals, pesticides and suspended solids. The indiscriminate dumping and release of wastes containing the above mentioned hazardous substances into rivers might lead to environmental disturbance which could be considered as a potential source of stress to biotic community. As for example, River Ganges alone receives sewage of 29 Class I cities situated on its banks and the industrial effluents of about 300 small, medium, and big industrial units throughout its whole course of approximately 2525 km. Identically Yamuna is another major river, has also been threatened with pollution in Delhi and Ghaziabad area. Approximately 515,000 kilolitres of sewage waste water is reported to be discharged in the river Yamuna daily. In addition, there are about 1,500 medium and small Industrial units which also contribute huge amounts untreated or partially treated effluent to the river Yamuna every day.

Similarly many other rivers were surveyed during past two decades with respect to their pollutional status. In addition to domestic and industrial discharge into the rivers, there were continued surface run off of agricultural areas, mines and even from cremation on the river banks. According to a report, over 32 thousand dead bodies were cremated at the major burning Ghats per year in Varanasi alone in the year 1984.

4.1 Pollution in the Ganga River

The Ganga Basin, the largest river basin of the country, houses about 40 percent of population of India. During the course of its journey, municipal sewages from 29 Class I cities (cities with population over 100,000), 23 Class II cities (cities with population between 50,000 and 100,000) and about 48 towns, effluents from industries and polluting wastes from several other non-point sources are discharged into the river Ganga resulting in its pollution. The NRCD records, as mentioned in audit report, put the estimates of total sewage generation in towns along river Ganga and its tributaries as 5044 MLD (Million Litres per Day). According to the Central Pollution Control Board Report of 2001, the total wastewater generation on the Ganga basin is about 6440 MLD.

Many towns on the bank of the Ganga are highly industrialised. Most of the industries have inadequate effluent treatment facilities and dump their wastes directly into the river. A high concentration of tanneries in Kanpur has further aggravated the situation. Besides other chemical and textile industries, Kanpur has 151 tanneries located in a cluster at Jajmau along the southern bank of the Ganga with an estimated waste water discharge of 5.8 to 8.8 million litres per day. Out of 151 tanneries in Jajmau, 62 tanneries use exclusively the chrome tanning process, 50 tanneries use vegetable tanning processes, and 38 tanneries use both chrome and vegetable tanning. The Indian government under the Ganga Action Plan (GAP) has implemented several schemes for the abatement of pollution of the Ganga by tanneries. However, there are violations of the pollution control measures, and tannery effluents are still found in the river.

4.2 Pollution in the Yamuna River River

Yamuna is the primary source of drinking water for Delhi, the capital of India, and also for many cities, towns and villages in the neighbouring states of Uttar Pradesh, Uttaranchal and Haryana. In the last few decades, however, there has been a serious concern over the deterioration in its water quality. The river has been receiving large amounts of partially treated and untreated wastewater during its course, especially between Wazirabad and Okhla, National Capital Territory (NCT) of Delhi. Pollutants flowing into the river are contributed from the waste of the cities situated along its bank. Once the lifeline of Delhi, Yamuna has now become the most polluted water resource of the country. It now looks like a sewer. From big industries and factories to people living in big colonies, slums and rural areas, all pollute the river with impurity because of untreated water. Increasing pollution of the Yamuna has now become an international issue and a cause of concern for environmentalists.

V. PESTICIDES' EFFECTS ON HUMAN HEALTH

The Aral Sea region is arguably the most prominent regional example of pesticide contamination and human health. According to UNEP (1993), pesticides caused oncological (cancer), pulmonary, and haematological morbidity, as well as inborn abnormalities and immune system deficits. Pesticides can have an adverse effect on human health in three different ways: 1) skin contact (handling pesticide products), 2) inhalation (breathing in dust or spray), and 3) ingestion (consuming pesticides as a contaminant on, in, or in food or water). Inhalation and skin contact while preparing and applying pesticides to crops pose particular risks to farm workers. However, a key source for the vast majority of people is eating food that has been exposed to pesticide contamination. There are two main effects on human health from pesticide runoff's degradation of water quality. The first is eating pesticide-tainted fish and shellfish, which can be particularly problematic for subsistence fisheries that are located downstream of significant agricultural regions. The second is drinking water that has been directly poisoned with pesticides. 33 pesticides have drinking water criteria published by the WHO (1993). The maximum amount of pesticides that can be consumed daily over the course of a person's lifetime without posing a significant risk to the person has been determined by numerous health and environmental protection authorities as "acceptable daily intake" (ADI) values. Wang and Lin (1995) discovered that Tetrachlorohydroquinone, a hazardous metabolite of the biocide Pentachlorophenol, causes significant and dose-dependent DNA damage when they studied substituted phenols. Pesticides have detrimental effects on organisms, including: 1) death of the organism; 2) cancers, tumours, and lesions on fish and animals; 3) inhibition or failure of reproduction; 4) suppression of the immune system; 5) disruption of the endocrine (hormonal) system. A low red-to-white blood cell ratio, an abundance of slime on fish scales and gills, and other signs of poor fish health include: 6) cellular and DNA damage; 7) teratogenic effects (physical deformities like hooked beaks in birds); 8), 9) intergenerational effects (effects do not become apparent until the organism is passed down via successive generations); and 10) additional physiological impacts, such as eggshell thinness. These effects may be linked to a mix of environmental pressures, like eutrophication and infections, rather than being entirely attributable to exposure to pesticides or other organic contaminants.

Water frequently contains pesticides. 39 pesticides and their metabolites have reportedly been found in the groundwater of various US and Canadian provinces. Children are four times more susceptible to the toxicity of pesticides than adults, so the calculation of the level of permitted pesticide in water is based on the exposure of children and adults. Additionally, considerable amounts of residues from pesticides that are "severely banned" due to their detrimental effects on human health were discovered in the water sources. The leaching of pesticide residues from soil into groundwater is how they get into the water supply and start to seriously affect human health.

VI. CONTROL OF POLLUTION

In the case of developing nations, the creation of policy instruments to combat industrial pollution is not only difficult but also very complex. The regulator is theoretically endowed with a wide range of material, moral, financial, and other tools. However, the existence of numerous small-scale industries (SSIs), which produce pollution, makes it difficult for any tool to work and ultimately results in failure. SSIs are a significant source of pollution because they lack the resources, know-how, technology, and expertise necessary to treat their effluent. Inflexible command-and-control regulatory strategies are also to blame for the failure of industrial pollution control. Little funding, little power, and political meddling limit the ability of regulators to act. Information asymmetries exacerbate these issues further. For all these reasons, numerous studies in India have found that despite a robust legal framework and the existence of a sizable bureaucracy to manage environmental regulation, implementation is very weak. The importance of informal regulation for achieving environmental objectives has been brought to light by the failure of formal regulation to control pollution. "Information disclosure" and "rating" have recently attracted a lot of attention as potential instruments for reducing industrial pollution. This strategy—sometimes referred to as the "third wave" of environmental policy—acknowledges the challenges of oversight and enforcement and recognises that there are many more channels for influence than just formal regulation or sanctions. Businesses are concerned about things like their reputation and potential future expenses due to accidents or liability, for instance. In addition, improvements in our understanding of asymmetric information are connected to the emergence of this new paradigm for regulation. In an effort to determine how informal pollution controls affected Indian River water quality, Goldar and Banerjee conducted their assessment. In order to achieve this, a five-year econometric analysis of the factors affecting the quality of the water in Indian rivers was conducted using data from 106 monitoring points along 10 significant rivers between 1995 and 1999. Results indicated a significant positive impact of informal pollution regulation on the water quality of Indian rivers.

Since 1980, riverine segments and other water bodies' water quality has gotten worse, according to data collected through the National Water Monitoring Program and river basin studies. Polluted river stretches and other bodies of water are those that do not meet the desired standards for water quality. The Ganga Action Plan (GAP) was created in response to the Ganga River's data deviating from the desired water quality criteria for that river.In the years 1988–1989, 10 river stretches that didn't meet the desired standards were found. In 1992, there were 37 polluted stretches, which included all the major river basins. In order to pinpoint the sources of pollution, such as urban centres and industrial units, the Central Pollution Control Boards (CPCB) and State Pollution Control Boards (SPCBs) conducted extensive surveys of the polluted river stretches. With the expansion of the monitoring network and the inclusion of more rivers in the regular monitoring, 86 polluted water bodies were discovered in 2002 (71 rivers and 15 lakes, ponds, and creeks), which did not meet the desired standards. Table 1 lists the number of polluted river and lake stretches by state.

What is occurring in the Yamuna is indicative of what is occurring in almost all of India's rivers. More than 700 million people in India lack access to proper sanitation. According to the United Nations, a lack of clean water causes the deaths of 2.1 million children under the age of five every year. The World Bank has also warned India that it is on the verge of a period of extreme water scarcity. The Yamuna is the best example of how this is demonstrated. The government extracts 1.1 billion litres of water per day from the capital's largest source of water. 3.5 billion litres of sewage are thought to be transported daily by the river by the time it leaves Delhi, transforming it into a massive drain. Fish and plant life cannot survive in its oil-black waters. Citywide, residents can smell methane bubbling from its surface. Despite spending 20 billion rupees (£240 million) since 1992, the government has not been able to see the results of its river cleaning efforts. Less than half of the river's sewage is being cleaned, and pollution levels have doubled.

Table 1: Polluted sections of Indian rivers and lakes, broken down by state.

Name of State	No. of Water	River	Lake/Tank/ Drain etc
Andhra Pradesh	8	3	5
Assam	2	2	-
Delhi	1	1	-
Jharkhand	1	1	-
Gujarat	10	9	1
Haryana	3	2	1
Himachal Pradesh	2	1	1
Karnataka	6	4	2
Madhya Pradesh	5	4	1
Maharashtra	15	15	-
Meghalaya	5	1	4
Orissa	5	5	-
Punjab	3	3	-
Rajasthan	3	3	-
Tamil Nadu	7	7	-
Sikkim	1	1	-
Uttar Pradesh	8	8	-
West Bengal	1	1	-
TOTAL: -	86	71	15

Source: Water pollution (Polluted river stretches)

VI. EFFECTS OF WATER POLLUTION'S

This problem has a wide range of effects. The bodies of water become shallower, and the water's clarity is compromised. The majority of the available oxygen is consumed by algae, which raises the BOD (Biological Oxygen Demand) and lowers the DO (Dissolved Oxygen) level. In addition, photosynthesis is occurring at a slower rate, which kills many aquatic plants. The amount of silt in bodies of water is increased by soil erosion, which lowers the water quality. Water bodies become enriched with undesirable chemicals when cow dung is left to rot along their edges. Cholera, typhoid, diarrhoea, hepatitis, jaundice, dysentery, and other water-borne diseases are caused by water pollution. They have an unsavoury odour

and a marsh-like appearance due to various unwanted plants and effluents. Even beyond being unsafe for drinking, water contamination can make it unusable for industrial or agricultural purposes. The entire area has dramatically shrunk as a result of encroachments that have grown on the water bodies. Anchar Lake in India, which has transformed into a marsh, is an illustration of this. Due to the entry of solid waste and effluents, the River Jhelum has been transformed into a drain. The fish population there is infected. The Dal Lake in Kashmir is often known as "a dirty pond."

VII. CONCLUSION

When it comes to eliminating weeds and insect pests from urban landscapes, pesticides are frequently regarded as a quick, simple, and affordable solution. However, using pesticides has a big price. Since pesticide residues have been discovered in soil, air, surface, and groundwater across the country, as well as due to urban pesticide use, nearly every aspect of our environment has been contaminated by pesticides. The environment and non-target organisms, such as beneficial soil microorganisms, insects, plants, fish, and birds, are significantly at risk from pesticide contamination. Contrary to popular belief, even herbicides can have a negative impact on the environment. In fact, because they are applied in relatively large quantities, weed killers can be particularly problematic. Using safer, non-chemical pest control (including weed control) techniques is the best way for each of us to contribute to reducing pesticide contamination (and the harm it causes) in our environment. The effluents shouldn't be allowed to dump into water reservoirs without proper pretreatment in order to prevent water pollution from other substances like sewage or industrial waste. To further prevent any type of water contamination, appropriate agencies must continuously monitor and analyse the water.

REFERENCES

[1] J. Jeyaratnam, “Health Problems of Pesticide Usage in the Third World,” British Medical Journal, Vol. 42, 1985, pp. 505-506.
[2] World Health Organization, “Guidelines for Drinking Water Quality, Volume 1: Recommendations,” 2nd Edition, Geneva, 1993.
[3] Risks and Remediation, Volume 1, Agro Environ Media, Haridwar, India, pp. 111-128.
[4] B. Goldar and N. Banerjee, “Impact of Informal Regulation of Pollution on Water Quality in Rivers in India,” Journal of Environmental Management, Vol. 73, No. 2, November 2004, pp. 117-130.
[5] Abdullah, A., Mehana, E.E. and Meki, A. (2008). Evaluation of lead and cadmium levels in freshwater fish farms at Qassim region, KSA. Journal of Agricultural and Veterinary Sciences, 1(2): 59-69.
[6] Gupta, D. K. Rai, R. S. Pandey and B. Sharma, “Analysis of some Heavy Metals in Riverine Water, Sediments and Fish from River Ganges at Allahabad, Environmental Monitoring and Assessment, Vol. 157, 2009, pp. 449-458.
[7] Singhania, Neha. “Pollution in River Ganga”. Department of Civil Engineering, Indian Institute of Technology Kanpur. October, 2011.
[8] Das, Subhajyoti. “Cleaning of the Ganga”. Journal Geological Society of India, Vol.78, pp.124-130, August 2011.
[9] Malik, D.S., Sharma, A.K. & Bargali, H. (2018). Status of phytoplankton diversity in relation to water quality of Bhagirathi riverine system in Garhwal Himalaya. International Journal of Advanced Science and Research, 3(1): 30-37.
[10] Sharma, A.K., Malik. D.S. and Bargali, H. (2018). Food and Feeding Habits of Schizothorox Richordsonii (Gray, 1832) Inhibiting Bhagirathi River, Tehri Garhwal, India., International Journal of Recent Scienti□c Research, 9(4): 25562-25565.
[11] Maurya, P.K., Malik, D.S., & Sharma, A.K. (2018). Impacts of pesticides application on aquatic environments and diversity. In: Kumar, V., Kumar R., Singh, J. and Kumar, P. (eds) Contaminants in Agriculture and Environment: Health