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BIOTA OF SAGARTAL GWALIOR, MADHYA PRADESH, AS A RESULT OF MANY CONTAMINANTS

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ABSTRACT:

The current research was carried out at Sagartal located in Gwalior city, Madhya Pradesh. It is a 0.48 km2 deep water pool established for municipal water supply during Tomar Dynasty in 15th Century. This urban pool is encircled by concrete walls and there is supply of surface runoffs during monsoonal season to fill it up. Basically, a rainwater-fed pool, it is a source of perpetual supply of water to the urban population of Gwalior City for different uses from historical period. However, infiltration of residential sewage and immersion of idols during festival seasons has brought significant contamination to this water body. Once flourishing with fishes and water fowl the urban pond is now clutching to life owing to degradative human activity. The current research hence, was carried up to evaluate the physicchemical state of Sagartal and consequences of its pollutants on the biota present.

1. INTRODUCTION:

In order to sustain life, water is one of the most essential commodities and a key natural resource needed for numerous purposes, including agriculture, forestry, urbanisation, and many more. Physical, chemical, and microbiological elements all play an important role in determining the quality of water in a given system. Water contamination is caused by a wide range of natural and man-made activities, including industrial, household, and agricultural operations. WHO (1984) estimates that water contaminants cause 30 to 80 percent of all human illnesses. There are several factors that affect water's chemical composition, including its mineral content as well as its chemical balance. Precipitation pattern, water depth, distance from contamination source, and soil qualities all have a role in pollution extent.

One of the most important natural resources is water, which is used to the fullest degree by humans. Water is a finite resource on our planet. The hydrological cycle refers to the fact that it is always repeating itself. The sun's heat evaporates the water in the world's oceans, seas, and inland lakes. With the aid of suspended matter, it rises to a given height and cools down to form clouds at a certain temperature. Large water droplets occur as the air gets saturated, and gravity pulls them to the ground, where they fall as rain. That which percolates through soil and recharges aquifers gets replenished. This is a good approximation of how water flows.

1.1 GLOBAL WATER SCENARIO:

A layer of 3000 metres deep would be enough to cover the Earth's surface, according to the United Nations' estimations of how much water there is on the planet (www.fao.org). Fresh water is just a tiny fraction of this tremendous volume. Most of the world's water resources (97.47%) are saltwater ocean and sea water, which humans cannot drink. Fresh water makes up just 2.7% of the earth's total water supply, with the remaining 75.25 percent frozen in the Polar Regions, mountains, and glaciers as ice and snow. There is just 0.04% of the air in the atmosphere (www.fao.org). As a result, these sources aren't often referred to as sources. A whopping 30.06 percent of the earth's water supply sits under our feet, where it is often

unreachable. As a result, humans rely heavily on surface waters, which make up less than 0.008% of the total water on the planet.

1.2 INDIAN WATER SCENARIO:

The water potential in the Indian viewpoint is as follows: A total of 1869.35 cubic kilometres of surface water are available in India per year. It is made up of rivers that flow from the east and west. A total of 431.42 cubic kilometres of groundwater potential is found in the Brahmaputra basin, Ganga basin, and Godavari basin.

1.3 TYPES OF WATER BODIES:

Seas and inland waters are the two main categories of natural waters, which include all of the water on the continents. With a typical 3.5 percent dissolved solid content, 2.73 percent is salt, saltwater may be defined by its enormous size and volume (NaCl). It is smaller in volume and has a salt concentration lower than 3%. Dissolved solids content less than 0.05 percent make up the bulk of the water in the inland areas.

Several characteristics, such as the presence or absence of organic matter, temperature, turbulence, vegetation, or turbulence, may be used to categorise water. According to Thirenemann's (1926) categorization, the most thorough. The following is the breakdown of the divisions:

1. Ground water
2. Springs
3. Running water (from brooks to rivers)
4. Standing water (lakes, lagoons, ponds, swamps etc.)
5. Sick water (salinity of 0.05% to 3%), brackish and neutron water (chemically rich) lakes, and other waters with special features.

1.4 ECOLOGY IN WATER BODIES:

Ecology is the study of the structure and function of ecosystems, focusing on the interactions between creatures and their nonliving surroundings. Lotic and Lentic environments are two of the most common forms of aquatic environments. The Lotic ecosystem is made up of all inland waterways in which the flow of the water is constant and predictable. A lotic ecosystem is hence one in which streams and rivers flow. Because of the erosion brought on by the flowing water, animals and plants that depend on these ecosystems must either migrate farther upstream or learn to adapt to ever-changing environmental circumstances.

The lentic environment encompasses all in-term waters with a consistent flow in a single direction or flow pattern. Although some movement may occur due to wind-driven waves and in the area of exits, the water in these systems is mainly still. Lakes, ponds, and marshes are considered typical lotic habitats. An oligotrophic lake, a eutrophic lake, or an ageing lake may be identified by a combination of the water's depth and its nutrient content. A young oligotrophic lake is one that is still developing. As a result of their depth and lack of nutrients, these lakes have been devoid of both plant and animal life.

Middle-aged ecosystems with shallow depths, salty or muddy bottoms, and adequate nutrients to maintain vast populations of plants, animals, and microorganisms have been called eutrophic. Senescent lakes have been at their lowest ebbs. In the bottom sediments, organic silt and muck make up a dense layer, while the nutrient levels are high and the depth is very shallow. While terrestrial or marsh vegetation grows along the banks, there is a substantial amount of rooted emergent vegetation throughout the system. The eplimmon, the thermocline, and the hypolimmon are three separate temperature zones in these lakes. Lower than the epilimmon is a rapid-temperature-change region known as the thermocline, and much lower than that is a

region of water that has remained at a constant 4 degrees Fahrenheit throughout the time, known as the hypocline. Water at higher temperatures will be concentrated in the upper upilimmon, whereas cooler water will be concentrated in lower levels of the hypolimmon. The sun can provide all of the energy needed for a typical lake ecology. Phytoplanktons, such as Chlorella, Clamydomonas, Synomora, and Spirulina, are the principal producers. Zoo planktons, such as Daphnia species, Cyclops species, copepods, and others, are important food sources. Phytoplankton abundance peaks at this epilimnon's euphonic depth. Water spiders, beetles and other insects situated in the marginal zone between the aquatic and terrestrial ecosystems have a high NPP and serve as the source of biochemical components from which nutrients are imported and exported. Secondary and tertiary consumers include fish. Snakes, turtles, and birds of prey may also be secondary and tertiary consumers.

There are many different kinds of species in this habitat. The biogeochemical processes in a lake or pond environment continue to run. The atmospheric and aquatic systems interchange gases and elements, and the elements cycle through the hydrosphere and lithosphere, respectively. In these cycles, the decomposers are crucial.

2. POLLUTION OF INLAND WATER BODIES:

Because it holds more nutrients or sediments than it expels over time, a lake or pond is an effective "chemical sink." A lake has a variety of qualities that allow it to keep materials that enter but do not exit the system. In buried organic deposits, nutrients and other compounds are frequently retained via a peat building (organic accumulating) mechanism. Autotrophic environments, such as lakes, may transform large quantities of inorganic material into organic biomass.

Lakes and ponds are frequently ideal sedimentation basins since they are not subjected to strong currents, waves, or high stream velocity. Two things happen at the same time as a result of system stagnation: the epilimnion loses nutrients and the hypolimnion loses oxygen. Organic material will continue to accumulate in the hypolimnion's regeneration zone throughout the summer as a result of plant and animal mortality and excretion. Inorganic phosphate and nitrate will continue to be formed when the bacteria living in the sediment break down the organic material. For an extended period of time, these nutrients will accumulate in the hypolimnion, which will lead to a depletion of nutrients in the epilimnion. Many plants would perish from a lack of nutrients at this time. Plant-dependent animals will likewise be exterminated. As a result, nutrients are now more likely to be found in the environment rather than inside living beings. Eutrophication is the term used to describe the enrichment of nutrients in a given environment.

At the atrophic stage, the nutrients have reached a sufficient level to support a vast number of plant and animal populations. Digotrophic Lake to Entrophic Lake is a fairly lengthy process in terms of the material ageing of lakes. Human activity hastens the ageing process by adding 80 percent nitrogen and 75 percent phosphorus to the lake, which accelerates it considerably.

2.1 POINT SOURCE OF POLLUTION:

Water contamination that comes from a single source, such as a pipe or ditch, is known as point source water pollution. For instance, a sewage treatment facility or a factory may fall under this heading, as could a municipal storm drain.

2.2 NON-POINT SOURCE OF POLLUTION:

No one discrete source contributes to non-point source pollution since the contamination is dispersed. It is very uncommon for tiny

concentrations of pollutants dispersed over a wide region to result in harmful nonpoint source pollution (NPS). Nitrogen molecules seeping from fertilised agricultural soils is a well-known case in point. An example of NPS pollution is nutrient runoffs in storm water from an agricultural area or forest.

According to Liebmann (1962), pollution by point sources like domestic sewage can be classified into four distinct levels. Protein, high molecular weight N-containing substances, polypeptides, grease, and their degradation products have heavily contaminated polysaprobic water. It has an unpleasant odour. Anaerobic situations are those in which the self-purification process begins because of the lack of oxygen. There were a lot of germs present at the onset of degradation.

The increase in dissolved oxygen and the presence of amino acids resulting from protein degradation have been used to classify water as being -mesosaprobic in type. There are still many bacteria, but algae have also been a considerable presence. Even if the water does not smell as awful as polysaprobic sewage, the oxygen requirement has remained high. There is a lot of oxygen in water of the type - mesosaprobic, yet there is low oxygen demand. Bacteria have declined, whereas other kinds and individuals of tiny creatures have thrived. Sewage has had a profound effect on the living world.

While the quantity of bacteria in the oligosaprobic water was negligible, it had a high concentration of dissolved oxygen. It has a lot of animals, but very few people. This aquatic ecosystem is very susceptible to changes in water chemistry. Even at extremely low quantities, none of the group's members could tolerate deadly compounds. Water saprobity may be determined not only by the quality and quantity of living creatures but also by the water's chemical features (the amount of organic matter and the bio-chemical oxygen requirement, for example).

3. THE ROLE OF POLLUTANTS IN THE ECOSYSTEM OF A LAKE OR POND:

This is how a lake ecosystem's overall mass balance for nutrients and other substances might be described: Inputs and inflows refer to the substances that enter the system, such as nutrients and other chemicals. In lakes, precipitation, surface runoff, or any human sources were the primary sources of inflows. Anthropogenic (human-caused) nitrogen input, such as fixation, as well as chemical (nitrogen and phosphorus) cycling within the wetland itself are all examples of nitrogen environmental input.

Surface water pollution happens when an undesired or dangerous substance enters an area of water in excess of the area's natural capacity to remove or dilute it. Water pollution is one of the many forms of pollution:

- Biological agents
- Organic and inorganic chemicals that enrich and over enrich
- Chemical toxins
- Physical agents etc. are mainly responsible for pollution.

Grossly speaking, human pollution is the cause of waterborne illness. Lakes and other water bodies may be contaminated by germs that can survive in wastewater. Among these pathogens are bacteria, protozoa, helminthes, and viruses. Lund (1978) classified four groups of these pathogens and described the most prominent representatives of each. The aesthetics of water are affected by the presence of oil, grease, and a variety of other items that float on the surface. Oil, for example, is a combustible substance that may cause a fire like the Cuyahoga River disaster in Cleveland in 1969. Reduced light penetration and decreased oxygen diffusion are two of the effects of floating materials, which also contribute to BOD. In tiny

concentrations, certain contaminants may be helpful to aquatic ecosystems. At all levels, other contaminants are dangerous.

3.1 EFFECTS OF WATER POLLUTANTS ON ECOSYSTEM AND BIOTA:

Surface waterways are impacted by human activities that produce water contaminants. Excessive amounts of plant nutrients set off a series of processes that often follow a pattern. Phytoplankton and periphyton changes in algae occur. It is common for species composition and productivity to have a significant impact on the latter. Species that are able to take advantage of the circumstances spring up. During the day, the water gets turbid/overly oxygenated; at night, it may turn anoxic, and the population plummets as blooms decompose. Toxin-producing species, such as blue green algae, become more prevalent as eutrophication progresses.

The macrophyte communities are altered by nutrient addition. Tolerant organisms may at first thrive, becoming a nuisance in their own right, as nutrients are more readily available. As a result, the variety of species is decreasing. Anoxic and sediment changes/harm even tolerant species due to increasing turbidity algal blooms. When there are just a few emerging species of macrophyte or none at all, the ecosystem is considered eutrophic. Sedimentation may alter nutrient intake in combination with an increase in solid effluent. These include the loss of phytoplankton blooms, the development of anoxia, and the decomposition of macrophytes.

Some species thrive in enriched settings and their output may be high in the overall loss of variety. Anoxia and water chemistry change are key contributors, but so is the loss of physical cover given by algae and macrophytes. When only a few species begin to falter, food web systems are at risk of collapsing completely. It's mostly chironomid midge larvae and oligochaete norm. With the disappearance of sensitive game fish and just a few of the remaining coarse fish, fish species are being significantly impacted.

In addition to the physiological changes, the entry's appearance or amenity value noticeably shifts. Pea-soup coloured waterways are the result of eutrophication. Cyanophytes and actinomycetes fungi produce a noxious muddy odour that can contaminate the surrounding environment. Serious health issues may develop. Humans who ingest water while swimming when exposed to some algal toxins are affected. Nitrosamines, a class of carcinogens, are particularly dangerous for adults. When there are a lot of effluents, the amount of precursors increases. Methaemo globinaeimia (blue body syndrome) is a disorder in which nitrogen molecules in drinking water attach to haemoglobin instead of oxygen, putting babies at danger of asphyxia.

3.2 WATER RESOURCES OF GWALIOR:

Several man-made reservoirs surround the city of Gwalior, including the Harsi Reservior, the Tekanpur Lake and urban lakes such as Sagartal, Janak Tal, Suraj Kund, and Laxman Talab. Gwalior's water supply is mostly on on the Tighra-Kaketo system, which is supplemented by groundwater. An additional reservoir of the Kaketo Dam on Narver River provides additional supplies to Tighra Dam on Sank River. Gwalior has a total of 190 MLD (41.85 MGD) of drinking water supply. Two PSC pipes transport water from the dam to Motijheel's two wastewater treatment plants (one ancient, one modern) (17 km long and diameter 1200 mm). The dam's water levels are checked daily and show that there has been no shortage in supply in the previous several years. Additionally, a vast network of bore wells and manual pumps is used to obtain large amounts of ground water. Tube wells supplement the WTP's supply, and the treated water from

Motijheel is sometimes blended with it. About 27 million litres (MLD) of groundwater are reportedly utilised each day for domestic use (6 MGD). On the basis of the number of tube wells reported in various zones, this estimate has been calculated.

4. WATER BODY STATUS AND CONSERVATION IN THE CITY OF GWALIOR:

There wouldn't be life as we know it without water. All activities, including economic, social, cultural and environmental, rely on it. Lakes, ponds and rivers provide a significant amount of surface water. Water bodies across the globe have degraded during the last several decades as a result of increasing human influences, such as sewage discharge, industrial solid and liquid waste, and chemical-rich agricultural runoff, caused by population expansion, industrialization, and urbanisation. After surpassing their capacity, water bodies show the effects of deterioration in the form of poor water quality, altered and reduced biodiversity, and an increase in eutrophication from meso to hyper states.

Water bodies are disappearing at an alarming rate as a consequence of urbanisation, and the lack of a good drainage system contributes to this. These have an impact on the hydrological cycle, which in turn affects water quality and quantity. The government's current growth plans are focused mostly on physical planning, with little regard for the environment. Many of India's water resources have been depleted during the last three decades, and as a consequence, some have vanished completely, while others are fighting for their very life. Gwalior's urban waterways are in the same state. In other parts of the city, the results are getting more dire. Because of this, it became imperative to identify the issue and devise local solutions for recuperation. Strategies for preserving and restoring our ecosystem's health must be developed in order to solve the issues. Traditionally ignored aspects of water management must be given more attention in order to maintain the long-term sustainability of water supplies. To satisfy the rising demand for water resources in cities, more supplies will be needed. However, the future of water management and use rests in properly limiting our demand for water resources. There should be an integrated water demand management plan that aims to reduce system losses, improve operational efficiency, promote rational use of water resources and fair distribution as well as explore alternate sources such as wastewater recycling for non-potable purposes. Improve efficiency in water distribution and usage in urban water delivery systems to maintain the long-term sustainability of water resources is the study's goal. The following are the study's intended outcomes:

1. Water supply and demand in an urban watershed are quickly assessed, and important point and non-point pollution sources are identified in a short period of time.
2. Identification of aquatic bodies using the Global Positioning System (GPS).
3. Develop a GPS map-based run of model after studying drainage pattern and flow measuring.
4. Identify and implement city-specific water quality improvement plans.

4.1 AIR QUALITY STATUS IN GWALIOR REGION, MADHYA PRADESH:

Human health is adversely affected by air pollution, which is a global concern. Gwalior, the capital of Madhya Pradesh, has one of the worst concentrations of suspended particulate matter (SPM) in the country, more than double the WHO limit for major cities. Particulate matter (PM) is a ubiquitous air pollutant, and it's particularly problematic because of its negative health effects, reduced visibility, and soiling of buildings, all of which increase the risk of early mortality as a result of high levels of air

pollution. Transportation, rising urbanisation and industry, and other factors all contribute to air pollution in Madhya Pradesh. Sulfur dioxide and solid particulates from fossil fuels, photochemical oxidants and carbon monoxide from automobiles, and a variety of other pollutants, such as hydrogen sulphide, lead, and cadmium, emitted by smelters, refineries, manufacturing plants, and vehicles, have all been linked to the negative effects of air pollution..

The Stockholm Declaration of 1972 said that human beings have a basic right to freedom, equality, and an appropriate standard of living in an environment that allows for a life of dignity and well-being. International commitments and decisions made at international conferences, associations, or other bodies are entrusted to the Parliament under the 1976 Constitution. Government officials in Madhya Pradesh were surprised when the Central Pollution Control Board released statistics showing Gwalior as the country's eleventh most polluted city in terms of particle matter. The state pollution control board's 2013-14 data supports the WHO study. An investigation by the Madhya Pradesh Pollution Control Board (MPPCB) showed that Gwalior has the highest percentage of cars above the state's allowed pollution levels of 23% for diesel and 6.9% for petrol. Official statistics from the MPPCB reveal that roughly 1,500 cars were found to be breaking pollution standards in the past fiscal year.

4.2 MAJOR POLLUTANTS PRESENT IN AIR:

Fossil fuels, private motor cars, poor building energy consumption, and the use of biomass for cooking and heating are all said to have contributed to the worrisome rise in pollution levels in Madhya Pradesh, and in particular in Gwalior. The SO2 emissions from industry are sulphur dioxides. Fossil fuel combustion is the primary source of nitrogen oxides (NOx), whereas transportation is the primary source of ozone (O3). If you have heart or lung issues, you may be at risk. Human health and the respiratory system are at danger as a result of this, as is the general population.

4.3 AIR QUALITY STANDARD IN GWALIOR:

According to the Central Pollution Control Board (CPCB) 2012 report on "national ambient air quality status and trends," Gwalior has India's highest particulate matter concentration at 329 micrograms per cubic metre. However, the situation has vastly improved since then. The city's particle matter level is at 141 micrograms per cubic metre, according to the latest data. Gwalior was named the most polluted city in India by the Central Pollution Control Board (CPCB) earlier this year. According to the statistics, particulate matter concentrations in Gwalior were 5 times higher than the allowable limit of 60 micrograms per cubic metre. There are just 12% of people living in cities where air quality is reported to meet WHO guidelines.

This standard's main objective is protection of public health from harmful impacts of air pollution and reduction, or elimination, of air pollutants that are known or expected to be harmful for human health and well-being (either directly or indirectly).

4.4 CAUSES OF AIR POLLUTION

Air pollution is caused by a variety of reasons, some of which include the burning of fossil fuels.

1. **Vehicular Pollution:** This is the primary cause of pollution. The number of automobiles on the road and the harmful pollutants they release, such as nitrogen oxide and carbon monoxide and sulphur dioxide, are steadily increasing throughout the city. Most of our transportation system is powered by fossil fuels. As a consequence, transportation contributes significantly to air pollution. These pollutants may have a substantial influence on our health

since they occur so near to where we live and work.

2. Industrialization: Industrialization is also accountable to maintain the air quality standard in the city. Most of the industry is near the city hence the emissions of industries harm the air primarily. In few years there is a quick development in industry so that the air quality standard also grows low.

3. Fuel quality: Air pollution is caused in part by contaminated gasoline. In Madhya Pradesh, low-quality fuels including coal, gasoline, diesel, and fuel oil are often utilised in power plants and vehicles. Many steps have been done to enhance fuel quality, including sulphur reduction in diesel and unleaded gasoline, yet the problem persists.

4. Government Policy: During the early stages of industrialization and automobile population increase, no pollution prevention measures were employed, resulting in excessive levels of air pollutants.

4.5 HOW VEHICLES EMISSIONS AFFECT US:

Smog is formed as a result of vehicle emissions. During the spring and summer, the reaction between nitrogen oxides (NOx) and volatile organic compounds (VOCs) in vehicle emissions may produce ground level ozone and other secondary pollutants. Wintertime temperature inversions may trap car emissions close to the ground. Nitrogen dioxide, carbon monoxide, and particulate matter concentrations may all rise as a result of this (PM2.5). It has been shown that exposure to smog may cause a wide range of respiratory and cardiovascular problems. Particulate matter levels around main thoroughfares are higher than elsewhere in the city, according to research. Asthma, chronic bronchitis, emphysema, pneumonia, and heart disease are all on the rise as a result of this increasing exposure.

5. CONCLUSION:

An essential natural resource for a wide range of human endeavours, water is not only a universal solvent but also one of the most valuable commodities necessary to sustain all life on Earth. Physical, chemical, and microbiological elements all have a role in determining water quality in a given system. There are numerous natural and man-made activities that contribute to the problem of water pollution in freshwater systems. Approximately 30 to 80 percent of human illnesses are caused by water contamination, according to WHO (1984). There is a little marsh called Sagartal near Gwalior, Madhya Pradesh, where we conducted our investigation. Since ancient times, the city of Gwalior has been a centre for the arts and culture, which the rulers have helped to nurture. Gwalior is situated in northern Madhya Pradesh at 26.22° N and 78.18° E. It is situated at an altitude of 197 metres on average. The majority of it is located inside the Bundelkhand region. With a size of 5,214.00 km2 and located in the Chambal River basin, Gwalior is completely landlocked. Temperatures in Gwalior range from late March to early July, with the humid monsoon season running from late June to early October, followed by a chilly dry winter from early November to late February. The city has a humid subtropical climate, according to Köppen's classification. It got as cold as 1°C, and it got as hot as 48°C.

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