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A Review Article on "Treatment of lake water by using aquatic weeds in India"

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ABSTRACT- Aquatic weeds are those unwanted vegetation which grow in water and hamper its use. Out of about 160 aquatic weeds, Eichhornia crrassipes, Ipomoea aquatica, Typha angustata, Ceratophyllum demersum, Salvinia molesta, Nelumbo nucifera, Alternanthera philoxeroides, Hydrilla verticillata, Vallisneria spiralis, Chara spp., Nitelia spp., Potamogeton spp. are of primary concern in India. Weeds enhance rates of evaporation many folds through evapotranspiration than that of open surface, thus cause great loss of water. Water hyacinth makes water unfit due to eutrophication and slows down the flow rate of water besides causing many health associated problems. Aquatic weeds can be controlled by several methods like biological, chemical and physical. Each method has its benefits and drawbacks. There are several popular control mechanisms for preventing the spread or eradication of aquatic weeds. Physical methods are suitable only for small scale infestation but when applied in large water bodies become ineffective due to high cost and regrowth. Chemical control has been practiced against aquatic weeds since long time in India but it is not prevalent. Control of small infestations with herbicides has often been very effective, but is heavily dependent on skilled operators who maintain longterm vigilance for appearance of regrowth or seedlings. In recent decades, there has been a significant increase in the level of nutrients dumped into water from industrial and domestic sources as well as from land where fertilizers are used or where clearance has caused an increase in run-off. Successful attempts have been made to control water hyacinth and water fern by use of exotic weevil Neochetina spp. and Cyrtobagaus salvinae in different parts India but for several other aquatic weeds, suitable bioagents are not available. Some species of herbivorous fishes (Tilapia spp. and Ctenopharyndon idella) have been utilized to control some submerged weed especially Hydrilla spp. with varying degree of success. This paper describes the treatment of lake water by using aquatic weeds in India. The ability of a mixture of Typha angustifolia and Eichhornia crassipes to remove organics, nutrients, and heavy metals from wastewater from a futala lake water were studied. Changes in physicochemical properties of the wastewater including pH, temperature, chemical oxygen demand, dissolved oxygen, biochemical oxygen demand (BOD), total P, TOC, conductivity, total Kjeldahl nitrogen, NO3−-N, NH3-N, and metal (Pb, Cd, and Zn) concentrations were monitored.

KEYWORDS- Wastewater Treatment, Aquatic Weeds, Lake Water, Constructed Wetlands, BOD, COD

I. INTRODUCTION

Water is an integral constituent of life and one of the most important natural resources. The present domain of life existing on earth has evolved in water (Hosetti. 2002). It has been the cause of rise and fall of many civilizations, which flourished along fresh water bodies and perished when they dried (Dayananda et al., 2002). All early civilization such as Babylon, Egypt, Chinese and Indian flourished around Euphrates, Nile, Yongtzekiag and Indus-Ganga basin respectively. Water presents a wonderful picture, where thousands of living genera, ranging from microscopic to macroscopic including chemo-synthetic bacteria, saprophytic fvmgi, micro and macro invertebrates, vertebrates, algae and higher aquatic plants live. From biological point of view, it is the most abundant part of the living and as such performs important role in metabolism. From the ecological point of view, it is chiefly a limiting factor among land animals in which the amount is subjected to great fluctuations. Aquatic animals also maintain a proper balance of water to live safely in different categories of water.

About 70% of the earth's surface is covered with water, contributing about 2.3% to freshwater and rest is salt water (Wetzel, 1983). Most of the freshwaters lie frozen as polar ice in polar region (Antarctica and Greenland) and is out of reach to humanity (Prakash, 2001). The earth's hydrobiological cycle continuously transform saline water from ocean

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into freshwater on land and back again. Thus the amount of water is regularly renewed by precipitation in the form of rain, snowfall or by melt of glaciers in the mountains and also supplemented by dew and fog drip in some locations. Freshwater is a gift of God, which would continue to be available in perpetuity and abundance (Kaul, 1977). The potential water supply is in reality much less due to unequal distribution of rainfall as well as man with the demographic growth (Wetzel, 1983). Easily accessible, in the form of freshwater, is found in ponds, lakes, rivers, reservoirs and in underground shallow aquifers. Aquatic weeds are more scientifically termed as aquatic macrophytes. They have a great role on aquatic ecosystem as because they are the secondary producer on ponds, lake, river, ditches or any other aquatic ecosystem. Some of them have a great importance on mineral recycling by their several enzymatic metabolic action. Macrophytes are essentially a part of an ecosystem which can assimilate some essential nutrients such as – carbon, nitrogen, phosphate – they are not only the uptaker of nutrient, but also the source of nutrient bank to the higher organisms, i.e. consumer. Some macrophytes are good pollutant remover such as (heavy metals), so they are the major part for waste water purification system in aquaculture practice. Many species population density in directly or indirectly related with respect to the scale of pollution owing to their pollution indicating capability. The macrophytes when grow enormously and can chock the water body so that it has no such environment for good and hyginic pisciculture practice. Then they are transformed “macrophyte to “unwanted or undesirable weed”.

It has been proved that some macrophytes are essential for growing some species of fish directly by consuming macrophytes (Ctenophrayngodon idella) or can be indirectly beneficial for nutrition or food chain. Macrophytes are the flowers, bushes and trees of the underwater wetland valued, they provide cover and spawning ground for fish, habitat for both invertebrate epiphytic community and food and habitat for the moose, muskrats and other animal. It can release O2 to the fresh water animal. They are the vital component of all fresh water thats why must be preserved in moderate abundance for a healthy productive lake. The physical factor of sediment, texture, wave action, water depth and light have the key role for macrophytes growth. Water depth restricts immergent vegetation to a maximum depth of a about 1.5m and wave action abroads immergent, free flowting and flowting leaved vegetation. Disturb the bottom sediment can pull up the rooted vegetation which can increase the turbidity and reduce the light availability to the submerged plants. Aquatic macrophytes generally collonies to depth receiving 1% - 4% of surface light intensity. The mean summer Sacchidepth is about 1.3 m and macrophytes might be expected down to a depth of 3.3 m. A complex interaction between the physical and chemical parameters with respect to water is well established. In general oligotropic pond has low abundance of aquatic macrophytes in relation to mesotrophic pond. Macrophytes are restricted to a fringe on the shoreline because light levels under water are low as a result of planktonic algal concentration in hyper eutrophic lake. Myriophyllum sp., Ceratophyllum sp. and Potamogeton sp. are the indicator of nutrient rich condition of pond. Plant growth has additional effect on the formation and distribution of aquatic bed form. Because stem and leaf obstruct the flow (Hickin, 1984). The ecological and economic impact with invessive species are of critical concern to land manager.

II. LITERATURE REVIEW

[1] Aquatic Weeds and Their Ecological Role in Vasant Sagar, Pusad, Dist. Yavatamal, Maharashtra (Ms) (2022)

- Vasant sagar was constructed on the Pus River. This project comes under watershed area of Pus project, which is in Godavari Valley on 20°1'41"N and 77°27'4"E. The Official Designation of the Project is " Pusad . Locally this is also known as "Pus Dharan / Vasant Sagar, " or "Upper Pus Lake". Project was constructed as part of irrigation projects by the Government of Maharashtra in the year 1971. It is fresh water body. The dam impounds on Pus River. Nearest city to dam is Pusad and it is situated in Yavatmal District of Maharashtra.
- The aquatic weds diversity of Upper Pus Reservoir was studied at four sampling stations during July. 2020 To Jan. 2022. The water body sustains heavy biomass throughout the period of research. Water is the one among

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the prime necessities of life required for growth and other activity of all living being. Wetland is among the most productive ecosystems in the world. Aquatic weeds always thrive in places of marshy lands and water logged areas of the world. The aquatic plants are the most important component of the aquatic ecosystem.

- Aquatic plants are key components for the well-functioning of wetland ecosystem for biological productivity and support diverse organisms and there by provide lots of goods and services for the dependent people. Due to rapid pace of urbanization formation of new human settlements and Industrialization weeds are in serve threat of extinction. It is there for an urgent and almost need to record and to access diversity potentially of these aquatic plant communities before they will vanish forever. No elaborate study regarding the aquatic weeds or mycrophytes of Pusad taluka Maharashtra has been carried out up to the date.
- So the present work is the first contribution to the biodiversity of aquatic weeds in Vasant Sagar. Pusad. During the present study, 8 species of fresh water aquatic weeds viz. Hydrilla, Eicchornia, Vallisneria, Pistia, Algae, Typha, Nymphaea have been reported.

[2] Microalgae Based Sustainable Bioremediation of Water Contaminated by Pesticides (2022)

- The use of pesticides in agriculture reduces the loss of crops and increases crop productivity. Agricultural discharge into water bodies increases pesticide toxicity in water. A pesticide, when entered into water bodies, attacks non-targeting species, which disturbs the aquatic life. Because of low-cost taking, high material removal efficiency, low sludgy amount, and generated biomass for economic benefit, biological bioremediation methods are mostly preferred. Algae are used to remove pollutants from the environment or to convert them into harmless forms. Bioremediation by algae is highly preferred as biomass generated is used in biogas and biofuel production.
- Algae fix carbon dioxide (CO2) and release oxygen (O2) by photosynthesis and increase BOD (biological oxygen demand) in contaminated water. Therefore, it is necessary to reduce the use of pesticides or dispose of them in the best manner.
- To be on the safer side and make our water bodies less toxic, it is necessary to make efficient water treatment arrangements.
- This review paper is to discuss everything about pesticides and bioremediation, the use of microalgae and fungi for the treatment of water contaminated by pesticides, and the factors affecting pesticide bioremediation.

[3] Pollutant Removal in Wastewater by Vetiver Grass in Constructed Wetland System (2013)

- Constructed wetland technology is one of the emerging and acceptable technologies because it can effectively remove all most all types of pollutants from waste waters without harming the environment. The objective of the present study was to find out the effectiveness of vetiver grass (Vetiveria zizanioides L. Nash) in the pollutant removal from waste water in constructed wetlands. The vetiver plants (Vetiveria zizanioides L.Nash) (ODV-3) were planted (Test group and control group) in the constructed wetland and after 90 days, the test group was divided into three (T1, T2, T3) and were treated with waste water (50% dilution) from automobile service station (W1), spray painting workshop (W2) and sewage (W3) respectively, and allowed to grow for further 15 days.
- At the end of the experiment (on the 15th day of waste water treatment), the treated water from the tanks was collected and analyzed for various chemical attributes. The plants were uprooted, and the plant biometric parameters and nutrient content were also determined. The chemical characteristics of the wastewaters analysed show that all the wastewaters were contaminated, and automobile service station effluent was heavily polluted. More than 50% percentage removal of pollutants especially nutrients after 15 days treatment of waste waters in constructed wetlands was observed, and it showed the efficiency of the vetiver variety for improving the water quality.

[4] Constructed Wetlands – Natural Treatment of Wastewater (2021)

- Constructed wetlands are engineered and managed wetland systems that are increasingly receiving worldwide attention for wastewater treatment and reclamation. Compared to conventional treatment plants, constructed wetlands are cost-effective and easily operated and maintained, and they have a strong potential for application in a small community. Constructed wetlands for wastewater treatment have substantially developed in the last decades.
- As an eco-friendly treatment process, constructed wetlands may enable the effective, economical, and ecological treatment of agricultural, industrial, and municipal wastewater.
- Constructed wetlands are very effective in removing organics and suspended solids, whereas the removal of nitrogen is relatively low, but could be improved by using a combination of various types of constructed

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wetlands meeting the irrigation reuse standards. The removal of phosphorus is usually low, unless special media with high sorption capacity are used. Pathogen removal from wetland effluent to meet irrigation reuse standards is a challenge unless supplementary lagoons or hybrid wetland systems are used.

- In this paper studies various case study related to Wetlands in Indian Cities and also described include systems involving both constructed and natural wetlands, habitat creation and restoration.

[5] Phytoremediation: A Promising Approach for Revegetation of Heavy Metal-Polluted Land (2020)

- Heavy metal accumulation in soil has been rapidly increased due to various natural processes and anthropogenic (industrial) activities. As heavy metals are non-biodegradable, they persist in the environment, have potential to enter the food chain through crop plants, and eventually may accumulate in the human body through biomagnification. Owing to their toxic nature, heavy metal contamination has posed a serious threat to human health and the ecosystem. Therefore, remediation of land contamination is of paramount importance. Phytoremediation is an eco-friendly approach that could be a successful mitigation measure to revegetate heavy metal-polluted soil in a cost-effective way.
- To improve the efficiency of phytoremediation, a better understanding of the mechanisms underlying heavy metal accumulation and tolerance in plant is indispensable.
- In this review, we describe the mechanisms of how heavy metals are taken up, translocated, and detoxified in plants.
- We focus on the strategies applied to improve the efficiency of phytostabilization and phytoextraction, including the application of genetic engineering, microbe-assisted and chelate-assisted approaches.

[6] Traditional plant and herbs used in rural area for prevention of disease caused by water pollution (2021)

- Water being the most vital requirement for the survival of the life in the planet becomes even more vital when its demand increases due to increase in population as well as due to scarcity of consumable water. This chapter explains about water pollution and the causes of it. It also elaborates about type of water pollution and water borne diseases like diarrhea, cancer, hepatitis and many more that affects the world immensely.
- Furthermore, it explains about different types of herbs and plants that is used by people of rural area to tackle the problem of water pollution and effectively manage the diseases caused by the same. Examples of herb or plant derived substances utilized for water borne diseases include malvaceae and amaranthaceae, to name a few.
- This present chapter elaborated about the effect of pollutants in causing water pollution. Human being plays a major role in degrading the quality of water and making it difficult for human consumption. Water pollution also gives rise to many water borne diseases which claims many lives around the globe. Water borne diseases are quite prevalent in rural areas due to lack of hygiene but rural population relies on herbal and plant products to cope of with various diseases that occurs due to water pollution. Plant and herbs can be potential target in future for dealing with the alarming issue of water pollution and the disease caused by it.
- Promising herbs that can be effectively used for management of water borne disease include, for example, Malvaceae, Amaranthaceae, Aracea, Alliace, Liliaceae, Saxifragaceae. Further research should to be carried out to know benefits of herbs in treatment of water borne disease.

[7] Microbial and Plant-Assisted Bioremediation of Heavy Metal Polluted Environments: A Review (2017)

- Environmental pollution from hazardous waste materials, organic pollutants and heavy metals, has adversely affected the natural ecosystem to the detriment of man. These pollutants arise from anthropogenic sources as well as natural disasters such as hurricanes and volcanic eruptions.
- Toxic metals could accumulate in agricultural soils and get into the food chain, thereby becoming a major threat to food security. Conventional and physical methods are expensive and not effective in areas with low metal toxicity.
- Bioremediation is therefore an eco-friendly and efficient method of reclaiming environments contaminated with heavy metals by making use of the inherent biological mechanisms of microorganisms and plants to eradicate hazardous contaminants.
- This review discusses the toxic effects of heavy metal pollution and the mechanisms used by microbes and plants for environmental remediation.
- It also emphasized the importance of modern biotechnological techniques and approaches in improving the ability of microbial enzymes to effectively degrade heavy metals at a faster rate, highlighting recent advances in microbial bioremediation and phytoremediation for the removal of heavy metals from the environment as well as future prospects and limitations.

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- However, strict adherence to biosafety regulations must be followed in the use of biotechnological methods to ensure safety of the environment.
- This review highlighted the effects of heavy metal contamination caused by some human activities on the environment, the possible health hazards, as well as the various mechanisms and enzymatic reactions used by plants and microbes to effectively remediate polluted environments.
- It revealed the usefulness of bioremediation as a better substitute for the removal of heavy metals from contaminated sites compared to the physico–chemical methods which are less efficient and expensive due to the amount of energy expended.
- Microorganisms and plants possess inherent biological mechanisms that enable them to survive under heavy metal stress and remove the metals from the environment. These microbes use various processes such as precipitaton, biosorption, enzymatic transformation of metals, complexation and phytoremedation techniques of which phytoextraction and phytostabilization have been very effective.

[8] Phytorid Bed Technology: A Sustainable Approach for Wastewater Treatment (2023)

- Phytorid Bed Technology is an environmentally friendly and sustainable method for treating wastewater using plants, soil, and microorganisms. It is a low-cost and low-energy alternative to traditional wastewater treatment technologies, making it particularly effective in regions with limited space, a lack of infrastructure, or high running expenses. The technology comprises a bed of gravel or sand with wetland plants that remove pollutants and nutrients from the water through physical, chemical, and biological methods.
- The treated wastewater is typically of high quality, with low levels of pollutants, and can be discharged into the environment or reused for non-potable purposes. Phytorid Bed Technology offers numerous advantages over traditional treatment methods, such as low cost, environmental friendliness, versatility, high-quality effluent, and aesthetic benefits.
- However, site-specific considerations and maintenance requirements must be considered when building and executing a system. Overall, Phytorid Bed Technology is a promising technology for sustainable wastewater treatment, with successful implementations worldwide.
- Finally, phytorid bed technology is an excellent option for treating wastewater in a sustainable and cost-effective manner. This method, which uses plants and bacteria to remove contaminants from polluted water, provides a creative alternative to typical wastewater treatment systems, which demand a lot of energy and maintenance. One of the primary benefits of phytorid bed technology is its ability to remove a wide variety of contaminants, including organic waste, nitrogen, phosphorus, heavy metals, and pathogens. This not only improves the environment by improving water quality, but it also encourages the growth of flora and fauna near treated bodies of water.
- Despite its tremendous advantages, phytorid bed technology is not without restrictions and obstacles. Temperature, pH, and hydraulic loading rate can all have an impact on the system's effectiveness, thus further study is needed to optimise its design and long-term sustainability. To summarise, phytorid bed technology has the potential to be an extremely useful instrument for encouraging sustainable development and environmental preservation. With further study and development, this technology can continue to provide an effective and environmentally responsible answer to the rising problem of wastewater treatment.

[9] Domestic Wastewater Treatment using Phytorid Technology (2017)

- In the developing technologies and growing environment, the usage of the water source plays a vital role and its been needed and used in large amount. Insufficient management of municipal and wastewater in immense environmental problems and increasing hygienic risks for the growing urban population thereby hampering poverty alleviation and a sustainable development of Indian society. But now days, the waste water is converted into a source for various purposes in different aspects by the use of phytorid technology. phytorid technology is a patented technology and being very effective in water pollution treatment it leads one step forward to sustainable treatment of wastewater in safe manner using Iris Pseudacorus (Yellow Iris) plants and natural source for the treatment without affecting the ecosystem.
- The Chrysopogonzizanioides is to increase the pH value and to reduce the nitrogen, phosphorous content. The coagulation and flocculation process is done by alum to have a turbidity and to remove the suspended solids.
- This method is more advantageous of cost effective, negligible operation and maintenance with minimum electricity, smaller footprint. The main focus of the project is to avoid the scarcity of the irrigation water and to avoid the odor in the treated water and to enhance the quality of the water to prevent ground water pollution

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by analyzing the nominal water parameters that need to be satisfied for reusing the treated water with the references of IS 3025 code book.

- The treatment results in the reduction of the BOD, COD, total suspended solids, heavy metal constituent and there is improvement in the pH level and decrease rate of the turbidity and hardness which satisfies the standards of the irrigation water needs and thereby the nutrients needed for the plant growth is obtained in the water is in specified rate that does not affect the growth and efficiency of the product.
- Thus, the Phytorid technology is economical, less area required, maintenance, easy construction and the energy is efficiently used with the sustainable ecology condition. There is no impact to the environment by the odor or the quality of the water which is turn result in less ground water pollution with effective irrigation.

[10] Performance Assessment of Domestic Wastewater Treatment Plants Operating on Different Technologies (2020)

- The study reveals that the performance of Delhi Gate and Shahdara STPs based on BIOFOR and Phytorid technologies are more efficient for the treatment of the municipal wastewater which can be further be safely disposed off into surface water and can be used for non-domestic purposes like irrigation, agriculture, cleaning of parks and streets.
- The effluent quality of Najafgarh STP based on EA technology is found to be less efficient as compared to the BIOFOR and Phytorid technologies. Hence, it is required to be operated and maintained properly with close supervision so as to achieve effluent quality standards as prescribed by the Indian standards.
- In present study, it is found that the BOD removal efficiency is highest for Delhi Gate STP based on BIOFOR technology and COD removal efficiency is highest for Shahdara STP based on Phytorid technology. The total suspended solids removal rate is highest for Delhi Gate STP.
- The other parameters for BIOFOR and Phytorid based STPs are also within the permissible limit as per Indian standards with good removal efficiencies.
- The effluent quality from Najafgarh STP which is based on extended aeration (EA) technology is found to be less efficient and this technology is not able to produce better quality of effluent.
- Therefore, it is concluded that Najafgarh STP needs to be operated, maintained and monitored regularly to improve the efficiency of treatment plant. The irregular power supply is also one of the reason behind the low efficiency of the Najafgarh STP causing unequalized flow in the STP.
- However, the quality of effluent for other STPs are satisfactory and can be disposed off into surface water or can be used for agricultural and irrigation purposes.

[11] Eco Restoration: River Weed Cleaning System (2022)

- The purpose of this work is to build a cost-efficient river cleaning system to clean the aquatic weeds, plastic waste and other garbage wastes present in the lake and to promote a slogan of 3Rs that stands for Reduce, Reuse, and Recycle. The robot collects the garbage from the water bodies with a conveyor belt and stores it in a collecting bin.
- An IoT application is used to control the robot, by setting up a Wi-Fi connection and controlling the propellers by using the Wi-F protocol, we can navigate the robot into the water. In this way, the robot greatly facilitates the task of restoring and maintaining the lake's ecosystem.

[12] Water Treatment through Wetland Filter (2017)

- The increase in population in India creating problems amongst us in the waste production. Sewage waste ,may be in solid suspension phase.It contains pollutants, like organic, inorganic bacteria etc. Present filtration is based on pollutant level in treated water which may lateron can applied for gardening purpose. Waste water sample collected from station A and station B ,after treatment is collected and analyzed with various parameters viz pH, Conductivity, DO, COD,BOD, As the level of COD and BOD were found to be higher than Burreau of Indian Standard recommendation. Various toxic metallic elements absorbed by plants,reducing the pollution level.
- The research work is based on the recycle of all kinds of waste water which comes from near by households, kitchen waste, clothing, bathing, some small scale Industries etc. which can be converted into useful water except for drinking purpose. This also includes conservation of water indirectly. The basic idea is to use the above recycled water for gardening, street cleaning, construction purpose, and pavment garden. It is not recommended for public usage in toilets provided by the cost as it can be misused.

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[13] Performance Studies of Water Treatment Plant at Kailana Lake Jodhpur City, Rajasthan, India (2018)

- Water constitutes are of the important physical environments of man and has a direct bearing on his health. There is no gainsaying that contamination of water leads to healthy hazards. Water is precious to man and therefore control of water supplies to ensure that it is potable and wholesome as one of the primary objectives of environmental sanitation. Water may be polluted by physical, chemical radioactive and bacterial agents.
- Therefore, safe water supply is a sine qua non of public health of a community. The aim of water treatment is to produce and maintain water that is hygienically safe, aesthetically attractive and palatable, in an economical manner. Though the treatment of water would achieve the desired quality, the evaluation of its quality should not be confined to the end of the treatment facilities but should be extended to the point of consumer use. The total existing filtration capacity is 120 MLD at Kailana Lake filter house. An attempt has been made to study performance evaluation of the water treatment plant at Kailana Lake Jodhpur. The performance evaluations of the plant have been carried out and results are discussed.
- The water supply to the city is provided from Kailana water treatment plant Jodhpur. Water treatment plant has capacity 120 MLD. Source of water is Kailana Lake at distance 8km.about 61% of total water supplied to the city is from this plant. The plant operates for 22 hours and 150 MLD water is being treated and supplied to the city.
- Daily water supply to the city 300 lakhs gallons in summer time or winter and monsoon time water supply 285-290 lakhs gallon. The design and construction of the plant is conventional one and comprises of various Clariflocculator, rapid sand filters, chemical house flash mixer, and clear water sump and pump house.

[14] Design of Water Treatment Units for Kumarakom Panchayath, Kerala (2021)

- In Kumarakom Panchayath (a local government in Kerala state, India), it is observed that the main causes of deterioration in water quality are due to the discharge of domestic wastes, municipal wastes and terrestrial runoff from seepage sites. So, it is necessary to design a water treatment plant for kumarakom Panchayath. A layout of the proposed plant was made consisting of various elements like Screens, Cascade aerators, Flash mixer, Clariflocculator, Rapid gravity filter and a Chlorinator. In this paper, we report the design of a flash mixer unit, rapid sand filter and a chlorinator for the plant. Initially, a physic-chemical analysis was done by collecting data regarding the quality of water in Kumarakom Panchayath.
- The parameters analyzed are pH, turbidity hardness, alkalinity, acidity, sulphates, chlorides, residual chlorine, nitrates, iron, dissolved oxygen, biochemical oxygen demand (BOD), chemical oxygen demand (COD), most probable number (MPN). Thereafter, a population forecasting was done based on survey details collected with which we could find the capacity of the treatment plant. So, based on the quality of water and capacity of the plant, we made a layout of the treatment plant. Finally, the design of the components was done.
- The study concludes that lake water of study area was moderately polluted in respect to analyzed parameters. pH, total hardness, chloride and fluoride were found within permissible limit prescribed BIS. But the higher values of BOD and bacterial content in present study attributed lake water were not fit for drinking purpose. It is necessary to aware local villagers to safeguard the precious river and its surrounding. The concerned authorities should strictly monitor the quality of drinking water being supplied to the consumers to ensure public health. A majority of the people as well as the resorts here now buy drinking water. Those who can't afford to do that depend on the lake water and water supplied by the panchayat, which is not very regular. So a water treatment plant is designed to purify the lake water to potable water standards. The design of water treatment plant is done by conventional method of water treatment plant design by assuming some constant values involves processes that alter the chemical composition or natural "behavior" of water. A coarse strainer including a removable basket screen with 50 to 100 mesh, is positioned at the intake point of surface water to remove larger particulate matter and this water is fed to the raw water tank. Treatment steps include the addition of chemical coagulants (clotting agents), pH-adjusting reagent chemicals that react to form floc. Floc then settles using the force of gravity into settling tanks or is removed as the water percolates through gravity filters. The clarification process is designed to removes particles larger than 25 microns.

[15] Wastewater Treatment Technologies: A Review (2021)

- Wastewater is the water that emanates from domestic sources, restaurants, establishment, industries, agriculture fields, etc. Around 80% of all wastewater is discharged into the world's waterways, and it creates health, environmental and climate-related hazards. The dissolved and suspended organic solids in wastewater are "putrescible" or biodegradable. It is important to treat the wastewater before discharging it. It is essential to reduce the impact created by the wastewater through different treatment methods and reuse the treated water for various purposes. The present study emphasis on various modern wastewater treatment technologies and

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compare their efficiency with traditional treatment methods, and also find the end-use possibility of treated water.

- Wastewater generation is unavoidable, but it can be treated in an effective way to minimize environmental impacts. Industrialization led to the introduction of new contaminants in pesticides, pharmaceuticals, cosmetics, etc. which have complex compositions and are hazardous in nature. Even though 75% of the earth's surface is covered by water the availability of drinking water is less than 1%. Putting this available water in jeopardy will bring us much more risk. In this situation, it is essential to treat the wastewater, to satisfy the drinking water standards. Many treatment methods are emerging for the ultra-purification of wastewater.
- Water treatment technology development and implementation have been primarily driven by three primary factors: the discovery of new rarer contaminants, the adoption of new water quality standards, and cost. During yearly periods, chemical clarification, granular media filtration, and chlorination were virtually the only treatment processes used in municipal water treatment.
- However, today we can see a dramatic change in the industry's approach to water treatment as they are seriously considering alternative treatment technologies to the traditional filtration/chlorination treatment approach. The NF technique can be applied for treating wastewater containing small contaminants. Also, it can soften the water along with purifying the water. However, it is observed that they are not durable which makes them uneconomical. The use of algae for wastewater treatment is a fascinating technique since it is highly economical, but it is seen that their efficiency depends on the climatic conditions.
- Biosorption is another emerging technology that is efficient in removing toxic ions and also their operation is simple. When it comes to cost, their application is not preferred. Advanced oxidation is a chemical treatment method, that is highly efficient in eliminating organic compounds, but their operation is also costly. Even though most of the emerging water treatment methods are highly efficient in removing contaminants, their cost of operation is expensive. Using algae bacterial symbiosis in treating wastewater shows much efficiency and is economical at the same time. Combining other treatment methods along with algae bacterial symbiosis can make the system more efficient and economical.

III. CONCLUSION

In case the third world war happens, (it should not happen) will only be due to water. Water is going to be the future resource of our energy and all related activities for human beings. The shortage of water will be felt by all the continents and people. The depletion of water source will create economy burden on all the nations, so it has become essential and necessary to save water and recycled water. The progress of every country depends upon the smart cities and existing major cities. The population of these cities is growing high and hence the consumption of water also becomes higher. The only solution is to recover and recycle the water spent on domestic consumption and industrial consumption by very good affordable water treatment plants. Aquatic plants which will not affect the deforestation and environment are used for the recovery of water as they are capable of absorbing metallic ions and toxins from the domestic waste water sample. These plants convert all the above unwanted material into useful nutrients for the plants so that the animals can also eat the same. The above plants reduce the higher level concentration which is available in the domestic waste water sample to the minimum acceptable level. This requires further research and observation. The above water become useful and suitable for other purposes.

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