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Experimental Investigation on Quality Assesment and Pollution Control of Odderpalayam Lake

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Abstract : This paper describes about an experimental investigation conducted to study the behaviour and parameters of lake water and treatment of the lake water sample by Bio Ozolyte Treatment process. Water quality on earth is depleted due to over increasing human development activities that over exploits and affect the quality and quantity of the water resources. The rapid urbanization has resulted in pollution of fresh water bodies due to increase generation of domestic waste, sewage, industrial waste etc.Even where expensive wastewater treatment plants are installed, only a small percentage of the total wastewater volume is treated before discharge resulting in rivers, lakes and aquifers becoming severely contaminated¹. So there is great need to treat waste water. In order to come out with an economically sound and Eco-friendly technology, for the effective waste water treatment we developed a treatment method called BIO-OZOLYTE System, which has high efficiency in removal of BOD, COD, COLOUR and ODOUR without high expenditures and also its nontoxic to the environmental. This system is clubbed with three technologies like Biological method (ECO-BIO BLOCKS), Ozonisation and Anolyte technology. The test results of combined sample for before treatment and after treatment values are compared with standard values sample parameter. These test result shows that dissolved oxygen in water increase and reduce BOD, COD, Odour and Colour.

Keywords : EcoBioBlocks, Anolyte, Ozonification, Ecoli Bacteria, Dissolved oxygen.

1.0 Introduction

Water is one of the most important elements on earth. Every living being needs water for its survival. Without water, plants, animals, microbes- everything will perish. Population growth- coupled with industrialization and urbanization has resulted in an increasing demand for the water thus leading to water crisis and serious consequences on the environment. It is fast becoming a scare commodity in most part of the world. Water resource comprising of surface water, ground water and marine and coastal water, support all living things including human being. Though water is available in the universe in huge quantity in the order of 1400 x 10⁶ Km³, only 3% of the water in the universe is fresh water. Among the fresh waters, only about 5% of them or 0.15% of the total world waters are readily available foe beneficial use. The total water resources available in India are 1850 Km³, which is roughly 4% of the world's fresh water resources¹³. Despite the seeming abundance of water on earth, as much as 42% (2.9 billion) of the world's population live in water- scare areas. Bio-Ozolyte System can replace the conventional and advanced treatment technologies, to treat the effluent or wastewater by overcoming the above mentioned difficulties as mentioned in table 1.1, 1.2, and 1.3. This method can be implemented for wastewater treatment because of its following beneficial:

- Capital cost will be reduced
- less power consumption
- Maintenance cost is less
- Less/no sludge generation
- Treated water can be used for agriculture
- No skilled labour is required
- The system is simple and flexible

1.1 Materials and Methods

Bio-ozolyte system is an emerging indigenous technology in the area of waste water treatment technologies like biological treatment along with aeration process followed by, ozonisation, carbon filtration and anolyte. From literature studies it has been found that these technologies can be worked out in their different combinations for obtaining better treatment efficiencies. This system is generally a primary, secondary and tertiary treatment system. The combination of advance technologies like Eco- Bio Block, Ozone and Anolyte along with the conventional technologies like Carbon filtration and Aeration, will improve the quality of treated waste water and also will be Eco-Friendly and Cost-effective^{2.3,4}. This technology will help for attaining better prospective use in the area of both industrial and municipal waste water treatment. The materials and the experimental methods are being discussed in the following section.

1.2 Eco-Bio Blocks

Changing lifestyle has introduced many chemicals and biotechnologically developed products in the basic human requirements like food, water, shelter and air. Water is available a plenty on earth. However, potable clean water is becoming a rare commodity. Where it is available the quality of the water for human consumption is highly susceptible. Adding further to the environmental pollution, is the free flow of untreated sewage, industrial and other wastes into the water bodies. Organic or inorganic chemicals are added to make impure water get rid off malevolent organisms, nauseating and pungent order. While these chemicals do purify water by killing organisms (useful and harmful), they also created a lot of side effects to the environment on sustained usage. To replace such human effects, sustainable greener technologies can be employed to treat the waste water in an eco-friendly manner. One such attempt is the usage is the of eco bio blocks for waste water treatment. Eco Bio Blocks is a natural way of cleaning the waste waters. Obtained through natural means. Japanese introduce this technology and it is widely being in the field of aqua culture and aquariums^{5,6}. Eco Bio Blocks does not harm to the human system as well as the environment. It is highly effective, less intrusive comes in different sizes and forms. Eco Bio Blocks fits into the existing system seamlessly. Eco Bio Blocks adds further to the aesthetics, while ridding the water of the odour.



Fig. 1.1 – Eco Bio Block

1.3 Eco Bio Blocks Composition

Eco Bio Block is non toxic. It is obtained from natural resources. Eco Bio Block is made by mixing effective microbes with cement and porous stones. It is obtained from volcanic resource called volcanic ashes. They are highly porous in nature. In India porous rock-soil materials blasted from various

kinds of Himalayan rocks and other geological structures are the common sources of Eco Bio Block material. It is made by mixing effective microbe (bacillus) with cement and porous stones^{7,8}. It does not contain any organic and inorganic chemicals. The microbes in Eco Bio Block are aerobic and survive in temperature of 10-110 being most efficient between temperatures of 25-60. They live both in air and water. The microbes live in pH 3 to pH 11. The microbes are demand in blocks and get activated immersed in water.

1.4 Working Concept of Eco Bio Block

The microbes when immersed in the waste water will get activated after certain retention period. The bacteria will start their multiplication process in the presence of atmospheric oxygen or externally added aerators. The replication of these bacteria in the wastewater will continue until the aeration or oxygen supply is present. This large mass of bacteria will start acting upon the waste water and the stabilization will be carried out. During this process, the bacteria will consume the organic solids present in the waste water. As a result of the metabolic reaction, complex organic molecules will be converted to some intermediate compounds and finally into simpler and products. This ends the stabilization process. The initial colour of raw waste water will be brownish to black colour. If the waste water colour turns yellowish, it is identical that the stabilization is completed. The bio block can be removed by washing the blocks and the blocks can be re-used.



Fig. 1.2 – Working Mechanism of Eco Bio Block

1.5 Ozone

Ozone is an elemental and chemically most active from of oxygen, an allotropic, to be specific. Ozone is 'active oxygen', nature's special element consisting of three oxygen atoms. Ozone was first discovered by **Mr.Schonbein**, in the1840's, when he discovered a unique odour during electrodialysis and electrical sparkling experiments. He recognized the odour same as observed after the lightening flash. He named the substance '**Ozone'** after the Greek word'**ozein'** meaning 'smell' and gave the formula 03. Pure ozone is an unstable compound, fairly bluish gas with a characteristic fresh, clean and penetrating odour noticed after a rain storm. It naturally occurs in the earth's upper atmosphere from the sun's UV rays and in the loweratmosphere during a thunder/lightning storm^{9,10,11}. There is always small amount of ozone in the air we inhale. Ozone can also be produced artificially by UV ray and high voltage electric discharge. Ozone is a naturally protecting and purifying agent. Ozone has been used since the turn of the country to purify drinking water. Today ozone is the common water purifying agent wherever available in the developed countries and a popular water purifying agent wherever available in the developing countries. In 1906, the city Nice, located in France.

1.6 Ozone as an Oxidizing Agent

The choice of ozone as an oxidizing agent is based on standard oxidation potential of 2.07V, which makes it 5.1 times stronger than chlorine and 3.2 times stronger than hydrogen and also hydrogen peroxide .ozone is regarded as the second most powerful oxidizing agent, behind fluorine. Moreover ozone is 1.5 times as dense as oxygen and 12.5 times more soluble in water and leaves no residuals or by- products except oxygen and a minimum amount of carbon dioxide and water. This removes the whole problem of sludge management from the waste water treatment practice.

1.7 Anolyte

Anolyte solutions are strong oxidizing solutions with a pH range of 2.5-8.5 and an Oxidation-Reduction Potential (ORP) of +600 to +1200 mV. Anolyte can potentially be used as a broad spectrum germicidal agent to kill all types of microorganisms including viruses, fungi and bacteria. Anolyte is a positively charged oxidizing

agent containing HOCL, O, O2 and O3-OCL, H2O2, etc micro bubbles that displays unrivalled disinfectant properties, and under controlled conditions, it is proven to give a multi-log reduction against selected microbes. Decontamination of wastewater without hazardous chemicals is possible by addition of Anolyte. Hence, no hazardous by-product or residue are generated during the treatment process and also after the process.

1.8 Aeration

The waste water when given bio block treatment should be aerated to produce multiplication of microbes from the Eco Bio Blocks. The waste water was aerated in the lab scale using a stone diffuser with help of air pump, which was operated using electric energy. Whereas, in the on- treatment air O^2 aerator was used to aerate a large volume of water, a surface aerator. The Bio block treatment should be given aeration without any interruption, hence the aerator employed should have the capacity to run continuously and also produce proper aeration, thereby increasing the treatment efficiency.

1.9 Activated Carbon Filtration

Activated carbon is a porous from of Carbon manufactured from coconut shell, wood or coal. Activation is achieved with steam and it develops pores with enormous internal surface area. The porosity creates a remarkable power of adsorption, an indispensable process in industrial waste separation, purification, and depolarization and recovery techniques. The carbon atom at the Activated carbon exerts an attraction (Vander walls force) of the molecules of surrounding liquid and gaseous substance and fixes on to the pore walls. This is the basis of mechanism whereby activated carbon and sand filter and it was employed in the lab scale studies, as shown in fig 3.4. In the On-line treatment, pressure filter was used with same sand-carbon-sand bed arrangements, but with the capacity to filter larger volume¹². Backwashing was also done in same apparatus with a separate outlet as shown in fig 3.5. There was further reduction in the TDS. If the TDS value was not up to the requirement, then the sample is once again circulated for ozone treatment until the required standard is acquired. Then the treated effluent was collected in a tank for checking it for irrigation purpose.

1.10 Bio-Ozolyte Methodology

Initially, Eco Bio Block treatment was given to the collected samples. Two litres of the samples collected were taken and a Eco Bio Block was immersed in each of the samples containers. Aeration was given continuously to the Eco Bio Block immersed samples. This was continued, until the waste water is stabilized completely. This will be indicated by colour change. After the waste water turns yellowish, the Eco Bio Blocks can be removed and aeration can be stopped. A litre each from these Eco Bio Block treated sample was taken for analysis. Another one litre of raw effluent and clarifier samples treated with anolyte (i.e.) 50ml of anolyte is added to each sample. Then, the samples were kept for 20 minutes without disturbing. Ozone injection was given to each of the anolyte treated samples. Since the ozone generator which was used has the capacity to generate ozone of about 5 grams/hr, 2.5 grams/hr of ozone was injected to the sample for about half hour. If the waste water is highly polluted, the quantity of ozone injection can be increased. Then finally, the samples are given Activated carbon + sand filtration. This carbon filtered samples were taken for analysis.



Fig. 1.3- Activated Carbon + Sand Filtration



Fig .1.4 Diagram of Aeration Treatment Process



Fig 1.5 Difference between Treated sample and Non treated sample

Table: 1.1 Result Showing the Physio-Chemical Parameters of Raw Water

SL.NO	PARAMETERS	METHOD	UNIT	RESULT	LIMITS
1	Electrical Conductivity	2510 B APHA 22nd Edition 2012	(µmhos/cm)	1940	-
2	Total Dissolved Solids	IS 3025 (P-17) 1984 (RA – 2006)	mg/L	1140	2100.0
3	pН	IS 3025 (P-11) 1983 (RA – 2002)	mg/L	7.79	5.5 - 9.0
4	Turbidity	IS 3025 (P-10) 1984 (RA – 2002)	mg/L	0.8	-
5	Total Suspended Solids	IS 3025 (P - 17) 1984 (RA - 2002)	mg/L	68	100.0
6	Sulphate	4500 SO4 2E APHA 22nd Edition 2012	mg/L	90	400
7	Total Hardness	2340 C APHA 22nd Edition 2012	mg/L	350	-
8	BOD	5210 - B APHA 22nd Edition 2012	mg/L	41	30
9	COD	IS 3025 (P-58) 2006	mg/L	168	250
10	Phosphorous	IS 3025 (P – 31) 1988 (RA – 2003)			
			mg/L	4.61	-
11	Nitrogen	IS 3025 (P – 34) 1988 (RA 2003)		2.66	-
			mg/L		
12	Ecoli	IS: 5887 (Part 1) 1976	cfu /100ml	15	10

Physio-Chemical Parameters

The physio- chemical parameters of the clarifier was analysed. The results are as follows:

SL.NO	PARAMETERS	METHOD	UNIT	RESULT	LIMITS
1.	Electrical Conductivity	2510 B APHA 22 nd Edition 2012	(µmhos/cm)	1610	-
2.	Total Dissolved Solids	IS 3025 (P-17) 1984 (RA – 2006)	mg/L	950	2100.0
3.	pH	IS 3025 (P-11) 1983 (RA – 2002)	mg/L	8.61	5.5 - 9.0
4.	Turbidity	IS 3025 (P-10) 1984 (RA – 2002)	mg/L	1.4	-
5.	Total Suspended Solids	IS 3025 (P - 17) 1984 (RA - 2002)	mg/L	12	100.0
6.	Sulphate	4500 SO4 2E APHA 22nd Edition 2012	mg/L	217	400
7.	Total Hardness	2340 C APHA 22nd Edition 2012	mg/L	216	-
8.	BOD	5210 - B APHA 22nd Edition 2012	mg/L	8	30
9.	COD	IS 3025 (P-58) 2006	mg/L	32	250
10.	Phosphorous	IS 3025 (P – 31) 1988 (RA – 2003)	mg/L	0.68	-
11.	Nitrogen	IS 3025 (P – 34) 1988 (RA 2003)	mg/L	54	-
12.	Ecoli	IS: 5887 (Part 1) 1976	cfu /100ml	10	10

Table: 1.2 Result Showing the Physio-Chemical Parameters of Treated Water

After the treatment process using BioOzolyte System, the parameters like colour, Total Dissolved Solids, Total Suspended Solids, pH, BOD, COD, Ecoli, Nitrogen, Phosphorous, Total Hardness, Sulphate, are reduced in maximum range.

Based on the lab scale studies subjected to the Bio-Ozolyte system, its performance has been evaluated in treatment of dyeing waste and the following conclusions are arrived:

- The combination of Eco Bio Block, Ozone, Anolyte, and Activated carbon filtration has proved to give best results for treating industrial textile dyeing wastewater.
- It is capable of drastically reducing various Physio-Chemical parameters like TDS, TSS, SULPHATE, pH, etc.
- The BOD and COD reduction is highly remarkable, leading to better treatment efficiency.
- The BOD removal was higher than COD removal percentage.
- This system is so flexible and eco-friendly.
- The efficiency of treated water is much similar and also in some cases much better than other
- physical and chemical treatments.
- The colour of the treated water is much better when compared to other treatments.
- The Bio-Ozolyte System is suitable for Hostel, Slaughter House, Industrial wastewaters and Municipality.
- As the treated samples of physio-chemical parameters are within the standard limits, so it can be used for irrigation purpose and re-dyeing process.

2.1 Suggestions for Future Work

With regard to the present investigation and if so any investigation to be carried out in the future, the following are suggested to be carried out:

- Performance of Bio Ozolyte System can be evaluated by varying the Ozone and Anolyte dosage.
- More number of trials shall be carried out to assess the sustainability of the treatment.

3.0 References

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