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Various Utilization of Moringa Oleifera for Waste Water Treatment

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Abstract – The Proposed study is to determine the suitability of Moringaoliefera as an alternative and cheap local coagulating material in the improvement of water quality in terms of turbidity, pH, and color and microorganism removal for Bhopal. This study completed in four phase and their results observed. From the phase one the results of this work indicate that bacterial deactivation can be achieved using sunlight alone and the disinfection rate was enhanced by 83% using batch reactor. The phase two results concluded that 0.5g/l moringaoleifera seed powder could be used as biocoagulant to get upto 88.7% turbidity removal and 32.5% TDS reduction .pH also got reduced and came under range 6.5-8.5 as according to WHO guidelines. So, plant biocoagulant could be a better option for rural areas as this seed is easily available in villages and it is already been consumed in various food items. It could be a better replacement for harmful chemicals in treatment of water. Phase three result The Photo catalysts are showing around difference of 4 degree which is around 10% increment in the temperature which is good sign so in initial experiment we did with TiO2 and AC on which AC is showing around difference of 1 degree so it is clear that we have to use the AC and next experiment was with AC"s amount variation and on that we got that on 27mg/l is showing best result in temperature. Last phase four result Design is at its theoretical mode and design can vary according to demand and supply. A simple model of 2 L is portable and workable for one person which is that best part of this project.

Keyword: Adequate Water Supply, Moringa Seed Powder, Moringaoleifera Seeds, Water Purification Methods

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INTRODUCTION

It is now generally accepted that life made its first appearance in the warm shallow coastal water and that life cannot exist without it. In the process of evolution man appeared on land but water has been so important for human life that we cannot think of our existence without water. The serious side of water pollution is caused by human action, urbanization and industrialization. The cause of pollution being:

(a) Sewage, which comprises decomposable organic problem& pathogenic agents,

(b) Industrial & trade waste, which comprise toxic agents,

(c) Agricultural pollutants, which comprise fertilizers & pesticides,

(d) Physical pollutants viz. heat (thermal pollution) and radioactive substance (WHO Tech. Report, 1968).

Before the completion of Bhoj wetland Project the upper Lake, Bhopal is especially affected with the inflow of untreated sewerage water and accumulation of silt & dead organic matter. The latter drawback is additional intense because the catchment area is large & silt, dead organic matter joins into the lake with the runoff of the rainy water throughout monsoon. The catchment area of higher lake is especially occupied by agriculture field wherever fertilizers, pesticides, pesticides are extensively used & the loose soil flow with the rainy water accumulates within the lake. The assessment of water quality changes during A decade is based on physic - chemical & biological analysis & the change in physic - chemical constituents of water can be reflected directly on the Biotic community of the lake. Upper lake of Bhopal is a main water body being one in all the previous system and supply of potable water for the city. Until 1947 the standard of lake water was therefore good that lake water was used as potable water while not pismire treatment. With increasing population load & explosion of town quality of lake water deteriorated to AN extent that even when the

standard treatment. Water system faces drawback in maintaining potable water quality standard.

MATERIALS AND METHODS

Sources of samples: The water samples were collected from Lower Lake and for phase 1, for phase 2 sample water is of Shahpuralake and for third phase the sample is normal tap water based on its applicability. These all are the major drinking water sources for local community of Bhopal. These water sources were selected to study the variation in quality as they have different characteristics (Lake one is stagnant and river water is flowing). For phase 1 we need water that contain the stagnant and flowing condition. For phase 2 we need high turbid water and shahpura lake water contains turbidity more than 100 which is good for results and similarly for third phase we need water that contains normal drinking water condition. The various water quality parameters like turbidity, temperature, pH, TDS were recorded for both the samples. These water samples were subjected to treatment using SODIS and then the water quality parameters were analyzed.

PET Bottles: The plastic bottles needverified to be an adequate and safe vessel forwater treatment with SODIS. Three numbers of ordinary plastic drinking transparent bottles was used in this experiment. The first bottle contains normal tap water, second contains lower lake and the third one is of Betwa river. These PET (Polyethylene) transparent plastic bottles are exposed to the daylight for some hours as shown in Fig.1(a).

(a) PET bottles (b) Batch reactor

Fig 1 Experimental setup of SODIS

Batch Reactor-. Evacuated tubular glass collectors consisting of two insulated glasslayers with vacuum to prevent heat loss and a metallic coating of copper is provided in the inner tube to conduct heat to the medium. The specification of the batch reactor is 30 cm in length and 3.4 cm in diameter. Evacuated tubes are kept on slanted mounting frame made of iron. Experiments have been performed to test the increment in the efficiency of SODIS reaction with the use of batch reactor. Batch reactor used for the experiment is shown in Fig.1(b).

Natural biocoagulant preparation:

Seeds were collected from nearby market. Dissections of the seed pods were executed by hand: The seeds were removed from the pods and were dried out in the hot sun for 2 days. Fine powder was made by using mortar and pestle.

Fig.2: seeds of moringaoleiferaFig.3 powder of moringaoleifera

Photo catalysts-

Photo catalysts are the regents that absorb sunlight and then produce the higher temperature and due to this property they are used in various kinds of solar applications. There are various examples of these kind of photo catalysts like Activated Carbon (AC), TiO2 Titanium Oxide, ZnO2 Zinc Oxide. In pictures below photo catalysts are clearly shown.

Weather Parameters:

The batch reactor and PET bottles exposed to natural sunlight, specific to weather patterns in Bhopal, M.P, India (23° 16' N, 77° 36' E). The ambient temperature was measured using digital thermometer (Fig.4(a)).The incident solar radiation was measured using a solar power meter(Fig.4(b)).The experiment was conducted on a sunny day between 10.30 and 15.30 h.

(a) Digital Thermometer

(b) Solar Power meter

Fig.4: Instruments used for weather parameters

Analysis:

The physiochemical parameters of water sample from lower lake were measured using TDS meter, Turbidity meter and pH Meter (Fig.5).The specifications of the instruments used for testing water samples are listed in Table 1.

TDS meter

Turbidity Meter

pH Meter

Fig 5: Instruments used for water quality testing

RESULT ANALYSIS

PHASE 1-

COMPARITIVE STUDY OF PET BOTTLES AND BATCH REACTOR UNDERSODIS

Water Quality parameters

The various physical and chemical parameters of water sample like pH, Turbidity andTDS were observed before and after treatment with SODIS.

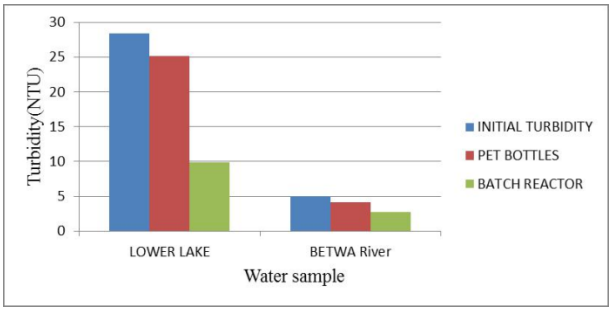

Fig. 6: Comparison of Turbidity of Water samples

Disinfection comparison between PET bottles and Batch reactor

Microorganisms are highly sensitive to heat. The temperature and revelation time plays a very vital role in exclusion of microorganisms. The experiment was carried with PET bottles/Batch reactor for around six hours with average solar intensity of 824 w/m2from 10.30 AM to 3.30 PM .In case of PET bottles, water temperature reached above 50ºC in six hours of constant exposure to the sunlight .

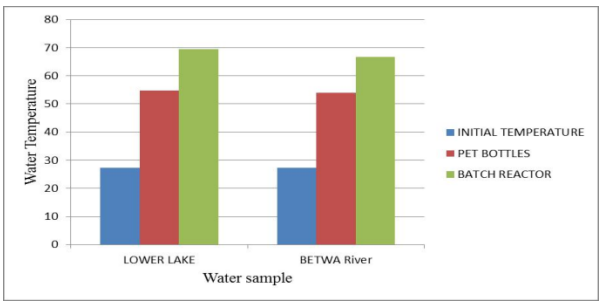

Fig.7: Comparison of water temperature of samples

PHASE 2

STUDY OF TURBIDITY REMOVERS LIKE BIOCOGULANTS

Physio-chemical properties of water

The various parameters were measured and the initial parameters are as follows-

Table 2: Initial parameters

Turbidity	44.6 NTU
pH	8.67
Electrical conductivity	651 µS
TDS(Total dissolved solids)	326 ppm
Temperature	30.3°C
% Nacl	1.3
ORP(Oxidation reduction potencial)	-97.6mV

Treatment with Moringaoleifera seeds

Turbidity-In case of sample1(0.5g/l) and sample2(0.7g/l) turbidity got reduced up to 4hrs of

experiment and after that a little bit increment has been seen in turbidity. But in case of sample3 (0.9g/l) and sample4 (1.1g/l) turbidity got reduced continuously up to 6hrs but at a very slow rate. The minimum turbidity measured was found in sample1 (0.5g/l) in the 4th hr of experiment and it was 5.03NTU as shown in fig 10.

Fig.8: water sample before treatment

Fig.9: water sample after treatment

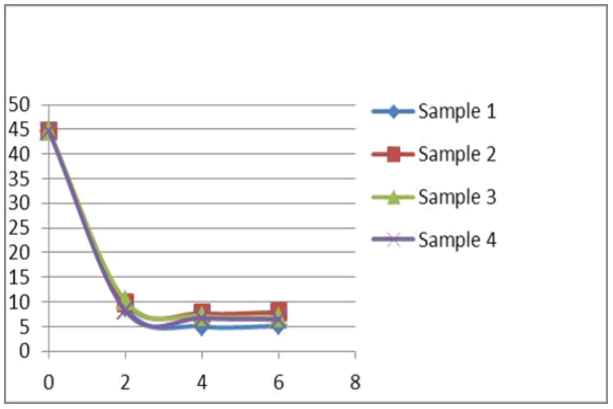

Fig.10: variation in turbidity

TDS- In all the samples, TDS increased upto 2hrs and after that in sample1(0.5g/l) and sample2(0.7g/l) TDS got reduced up to 4hrs of experiment and after that a high increment has been seen in TDS as shown in fig.4.4. But in case of sample3 (0.9g/l) and sample4 (1.1g/l) TDS got increased continuously up to 6hrs but at a very slow rate as

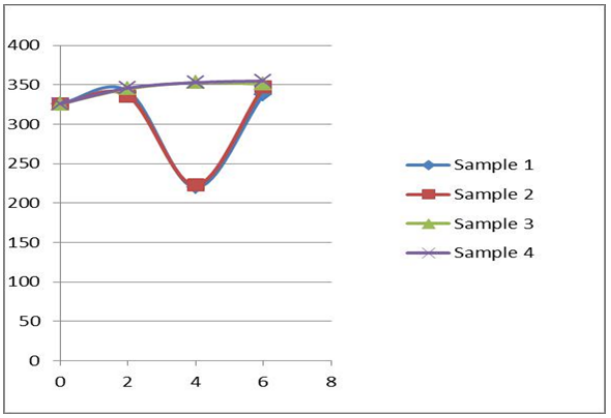

Fig.11: variation in TDS

pH- - In all the samples,pH is decreasing upto 2hrs and after that in case sample1(0.5g/l) pH got decreased continuously up to 6hrs. In case of sample2(0.7g/l) and sample3(0.9g/l) pH got reduced up to 4hrs and then it got increased by certain value. In case of sample4 (1.1g/l) pH got reduced up to 2hrs, then increased up to 4hrs and then again decreased up to 6 hrs as shown in fig 12.

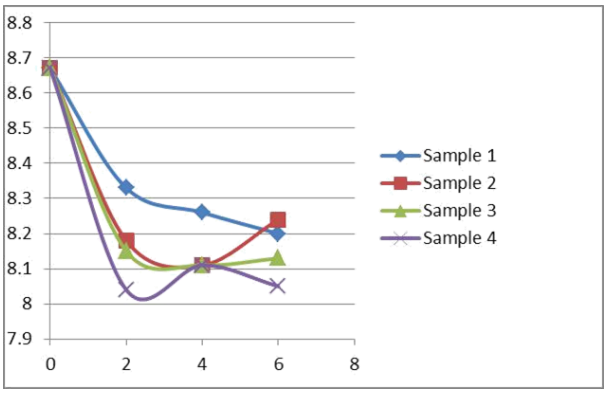

Fig.12: variation in pH

PHASE-3

STUDY OF PHOTOCATALYST FOR TEMPRATURE ENHANCEMENT FORHIGHER DISINFECTION RATE UNDER SODIS

To perform the comparative assessment of SODIS with batch reactor and PET bottles for water disinfection using photo-catalysts we selected two photo-catalysts that we selected from various study on the basis of papers and finally come to conclusion to use the Activated Carbon and TiO2 Nano-powder.

Sample 1 (Normal TAP Water)								
Time	Ambient Temp.	Solar Intensity	Temp. in SODIS	Temp. In Batch Reactor	pH in PET	pH in B.R.	Turbidity in PET	Turbidity in Batch Reactor
10:30	27.5	788	21	28	7.7	7.7	3.6	3.1
11:30	33.1	945	32.4	53.1	7.78	8.5	3.7	3.16
12:30	36.2	955	37.9	52.9	8.58	8.8	5.26	3.52
01:30	35:7	933	41.6	65.7	8.25	8.84	4.21	3.29
02:30	36.4	740	41.9	70.6	8.28	8.63	4.01	3.3
03:30	27.3	581	37.9	59.8	8.32	8.68	4.38	3.74

Sample 2 (TAP Water with Activated Carbon) 10mg/lt								
Time	Ambient Temp.	Solar Intensity	Temp. in SODIS	Temp. In Batch Reactor	pH in PET	pH in B.R.	Turbidity in PET	Turbidity in Batch Reactor
10:30	27.5	788	21	28	7.7	7.7	3.6	3.1
11:30	33.1	945	33.5	53.2	7.69	8.6	3.74	3.23
12:30	36.2	955	39.6	53.6	8.4	8.78	3.92	3.63
01:30	35:7	933	42.8	66.3	8.24	8.7	3.95	3.5
02:30	36.4	740	43.6	72.1	8.29	8.65	4.06	3.46
03:30	27.3	581	38.8	62.3	8.3	8.67	3.52	4.1

Sample 3 (TAP Water with TiO2 Nano Powder) 10mg/lt								
Time	Ambient Temp.	Solar Intensity	Temp. in SODIS	Temp. In Batch Reactor	pH in PET	pH in B.R.	Turbidity in PET	Turbidity in Batch Reactor
10:30	27.5	788	21	28	7.7	7.7	3.6	3.1
11:30	33.1	945	31.5	51.7	7.43	8.46	7.9	24.8
12:30	36.2	955	38.1	53.2	8.62	8.58	27.7	14.6
01:30	35:7	933	42.1	64.8	8.26	8.47	42.3	8.85
02:30	36.4	740	43.5	71.0	8.29	8.53	24.1	6.5
03:30	27.3	581	39.2	60.9	8.19	8.56	45.0	10.6

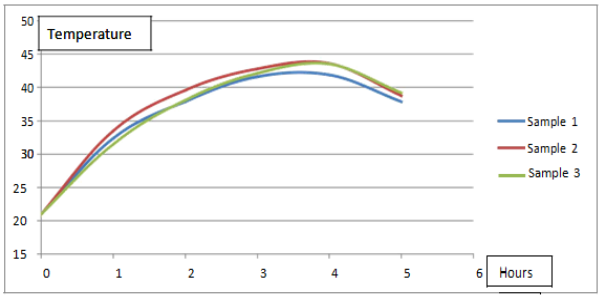

Fig.13. Temperature Plot under SODIS with PET

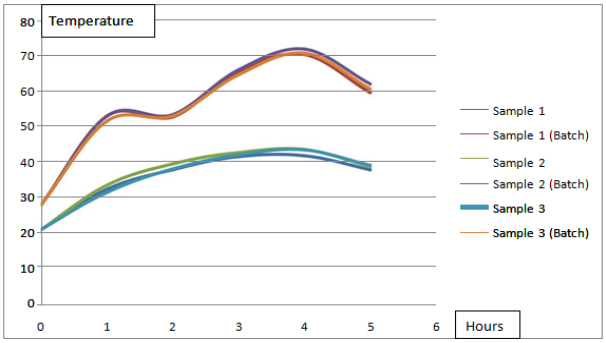

Fig.14: Temperature Plot on SODIS in PET and Batch Reactor

Now we have found that Activated Carbon in showing good temperature variance with Temperature and showing a difference of around 4 degree so to check the maximum amount that is showing optimum efficiency is decided by taking AC in different proportions. We prepared three samples one with 10 mg/l, second with 20 mg/l and last one with 50 mg/l.

Sample 1 (10mg/l)						
Time	Temperature	Turbidity	pH	Conductivity (us)	TDS (ppm)	% NaCl
Sample 0 hour	20.5	4.41	8.23	263.2	131.6	0.5
One Hour	34.1	4.35	8.2	228.2	114	0.48
Two Hour	40.2	4.28	8.19	249.3	124.7	0.5
Three Hour	44	4.52	8.16	253.5	126.7	0.5
Four Hour	40.6	4.25	8.23	247	123.3	0.5
Five Hour	37.3	4.2	8.2	243.1	121.0	0.5

Sample 2 (20mg/l)						
Time	Temperature	Turbidity	pH	Conductivity (us)	TDS (ppm)	% NaCl
Sample 0 hour	20.5	4.41	8.23	263.2	131.6	0.5
One Hour	35.9	4.65	8.12	240.5	120.7	0.5
Two Hour	42.2	4.74	8.18	253.7	126.7	0.5
Three Hour	46.1	4.78	8.19	255.7	127.5	0.5
Four Hour	41.9	4.35	8.14	254.1	127.0	0.5
Five Hour	39.1	4.28	8.1	252.8	127.0	0.5

Sample 3 (50mg/l)						
Time	Temperature	Turbidity	pH	Conductivity (us)	TDS (ppm)	% NaCl
Sample 0 hour	20.5	4.41	8.23	263.2	131.6	0.5
One Hour	35.0	4.92	8.09	254	127.2	0.5
Two Hour	41.4	4.82	8.21	256.8	128.3	0.5
Three Hour	46.2	5.3	8.17	268.8	134.7	0.5
Four Hour	41.1	4.91	8.11	253.7	126.8	0.5
Five Hour	39.0	4.7	8.05	251.2	118.2	0.5

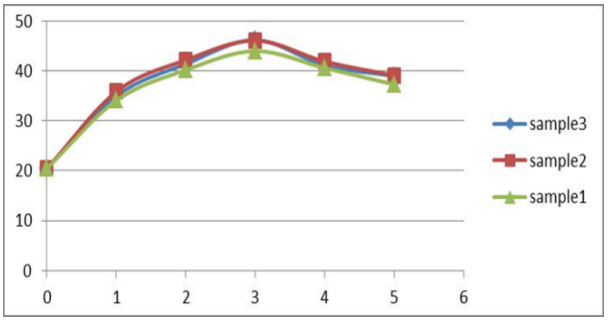

Fig.15 Temperature Plot with Activated Corbon

PHASE-4

EXPECTED WATER PURIFICTATION SYSTEM (MODEL)

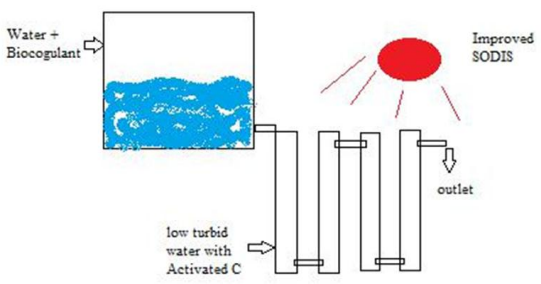

Fig.16 Theoretical Model of Water Purification System

CONCLUSION

The conclusion of that study is that

- SODIS time reduced from 6h to 1h which is more than 80 % efficient with batch reactor.
- Bio-coagulants reduce the turbidity around 75% and with moringa it reduces from 40 NTU to 8 NTU.
- Photo catalyst AC is increasing temperature for disinfection around 4 degree which is 10% increment in temperature which definitely increases the disinfection rete.
- Overall design is portable as well ecofriendly.

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