

Removal of Heavy metal from waste water of Jayantinala by Bioremediation

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Abstract: Bioremediation is a biological method and state of art technique that deals with natural environment processes to completely remove toxic contaminants. Any process that usages microorganisms, fungi as well as green plants to coming back the natural environment changed by pollutants to its original situation. Bioremediation technique can be generally distinguished in situ and ex situ. In situ bioremediation contains treating the contaminated material at the site and while ex situ bioremediation contains the elimination of the contaminated material to be treated elsewhere. Some most common examples of bioremediation technologies are bioventing, bioreactor, composting, land-farming, bio augmentation, rhizofiltration, and bio-stimulation. Microorganism that helps to bioremediation is known as Bioremediators. Not all contaminants and heavy metal are easily preserved by bioremediation with help of microorganisms. For in case heavy metals i.e. cadmium, chromium and lead is not readily captured by microorganisms. The acclimatization of metals contain mercury into the food chain may deteriorate matters. In this study we are going give the brief knowledge about principles of bioremediation, factors of bioremediation, application of bioremediation to treat industrial waste.

Keywords: Bioremediation, microorganisms, land-farming, industrial waste, Bioremediators.

1. INTRODUCTION

Waste water is harmful to human and environment without any treatment. The principle sources of domestic waste water in a community are the residential areas and commercial districts. wastes that contain the solid and liquid releases of humans and animals and are considered by many to be the most hazardous from human health view. The primary health hazard is presented by millions of bacteria, viruses and other microorganisms present in the waste stream

Expanded development exercises because of urbanization and industrialization are enormously liable for water contamination in Kolhapur city. Panchaganga river is one of the dirtiest waterways on the planet. Every day 91 million Liters/day. The assessed Civil waste water is to the tune of 90 million liters for each day which arrives at the stream Panchaganga through two regular nallahs, to be specific Jayanti Allah and Dudhali Allah. Because of the water contamination, there is an issue of satisfactory flexibility of consumable water. Water contamination has made genuine effect on human life because of different water borne infections. Industrial waste water of Jayanti Nala and Didhali Nalas, domestic waste water are the main sources of the Panchaganga River pollution. Due to huge amount of waste water Kolhapur Muncipal Corporation got 131 times notices. Every day 165 metric tons' /day solid waste produces. Other than Panchaganga waterways eight MIDCs, seven sugar processing plants and 174-gram panchayat town produce squander water which goes to the stream (Dhote and Ingole et al, 2012). In the year 2012, more than 500 cases of jaundice and many deaths were reported in the textile area of Ichalkaranji, Kolhapur. This is also main cause of contaminated water for the Panchaganga River

Bioremediation:

Bioremediation is useful for the complete damaging of a waste water contaminants. Its non-hazards for environment there is no side effect to humans. Instead of moving contaminants from one environment medium to another, the complete damage of target pollutants is possible. Bioremediation has been proven less cost than other technologies used for clear-out of hazardous wastes.

Microorganisms reduce contaminants because in process they received energy that allows to grow then it will reproduce. Microorganisms received energy from the contaminants by breaking chemical bonds and moving electrons from the contaminants to an electron acceptor, such as oxygen. They "invest" the energy, along with some electrons and carbon from the contaminant, to produce more cells.

Description of Jayanti Nala:

Jayanti Nala start from Kalabma lake and having length of 9 km. At Hutatma Park, Gomati Nala mixes with the Jayanti Nala and form a big Nala basin. This accounts for more than 60% of the total sewage generated in the city. This water is then pumped to the pumping station and is eventually sent to the STP located at Kasaba Bawada, Kolhapur (MPCB report 2009).

Source	Flow rate (million liters per hr.)			Flow rate (MLD)	Flow rate (MLD) as reported by KMC for 2002-04)
	Time Period				
	8AM- 10AM	1PM-3PM	5PM-7PM		
Jyantinala	0.8	1.5	1.4	24	70.1

Table.1 Flows and Characteristics in Nala Basin in Kolhapur report

PUBLIC HEALTH ISSUES IN KOLHAPUR CITY:

The causes of Jayanti Nala pollution are industrial waste water, domestic waste water, solid waste, over utilization of the fertilizers, hospitals, hotels, small industries and business are responsible for increase in public issues.

Total Population of Kolhapur City (2001 census)	Water usage (per day)	Waste water without treatment (per day)
4.93 Lakhs	120 million Liters	100 million Liters

Table.2 Public health issues in Kolhapur

Agro chemicals used in the fields:

Sr. No.	Type of agrochemical	Solid state (per year)	Liquid state (per year)
1	Chemical fertilizers	78,244 tons	–
2	Pesticides	1,41,764 tons	22,068 Liters
3	Weedicides	34,995 tons	21,664 Liters
4	Fungicides	6771 tons	1828 Liters

Table.3 Usage of agrochemicals in Field

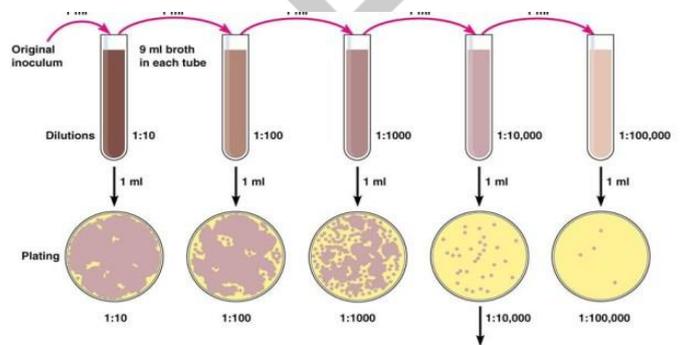
2. METHODOLOGY

There are two methods for identifying bacteria

1. Standard plate counting

This method is easy and less expensive. Firstly, we prepared culture media. Agar – Agar media (std. media) was used as culture media. After this we went for series dilution.

In standard plate counting method we taken 10 test tubes each of test tube labeled as 10-1, 10-2,10-3 up 10-10. then filled each test tube with 9ml distilled water and 1ml sample. Then added 1 ml solution from test tube 10-1 and added it test tube 10-2 and shake properly. Taken sample 10-2 transferred to 10-3 and repeat the same procedure up to 10-10 sample test tube.



Calculation: Number of colonies on plate × reciprocal of dilution of sample = number of bacteria/ml
 (For example, if 32 colonies are on a plate of 1/10,000 dilution, then the count is 32 × 10,000 = 320,000 bacteria/ml in sample.)

Fig.1 Series Dilution

1. Pour plate method:

After standard plate counting method the second main method is pour plate method.

In this method main purposed to grow bacteria. For growth bacteria taken 0.1 ml sample from bacterial dilution sample 10⁻¹ and spard it on petri dish then add agar-agar solution for growth of bacteria. Then petri dishes kept in an incubator at 37°C for 18 hrs. Incubator is used to grow bacteria as well as bacterial colonies. Bacterial colonies are properly grow then we contact individual bacteria with waste water sample by using one of contacting technique ex. shaking. Then carried analyzing of sample means checking of effectiveness of bacteria on the basis percentage of heavy method consumed. Then last nomenclature of bacteria with help of morphological, biochemical and antibiotic in inhibition test. At last we find most contributed bacteria to consume much amount of heavy metal and separate nomenclature of them.

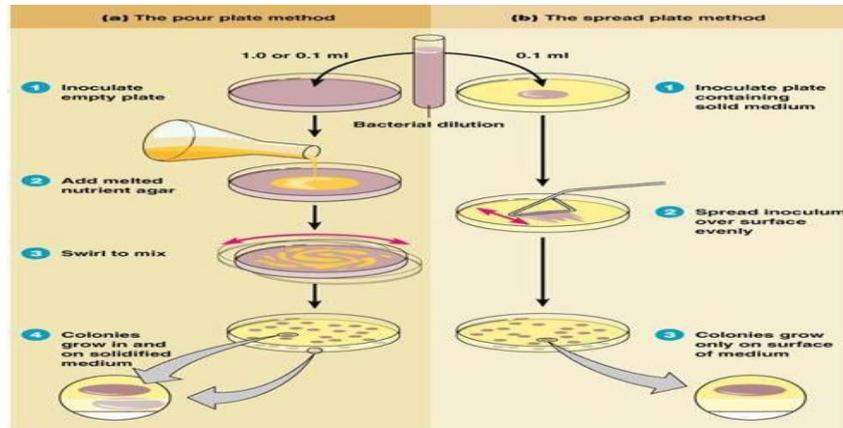


Fig. 2 Pour plate method

3. Result and discussion

Sr. No	Parameter	Unit	Siddhi Vinayak Mandir	Pumping station
1	pH	----	7.31	6.97
2	EC	mg/l	664	974
3	TDS	mg/l	431	468
4	Hardness	mg/l	320	380
5	COD	mg/l	540	600
6	BOD (3 days 27 [^] c)	mg/l	130	187
7	DO	mg/l	0.8	0

Table.4 properties of waste water

Sr. No	Sample	Heavy metal content in mg/lit					
		Mn	Ni	Cr	Fe	Zn	Cu
1.	Siddhi Vinayak Mandir	0.351	0.154	0.004	0.686	0.038	0.504
2.	Pumping station	0.288	0.141	0.001	0.868	0.027	0.119

Table.5 Heavy metal concentration of Jayanti stream water

Sr. No	Sample	Heavy metal content in mg/lit					
		Mn	Ni	Cr	Fe	Zn	Cu
1.	SiddhiVinayak Mandir and pumping station	0.289	0.147	0.0025	0.77	0.0382	0.3115
	Bioremediator	strict anaerobe	Flavobacterium SP	Bacillus Subtilis	Nostoc SP	Nostoc SP	Micrococcus SP

Table.6 Heavy metal concentration and Bioremediator of Jayanti stream water [12]

4. Conclusion

This paper relates to the study regarding Jayanti Nala of Kolhapur city. Panchganga river is the main source of water in Kolhapur. As the Nala is in Kolhapur which is finally covers in the Panchganga river it possesses a threat to the human, animal and aquatic species. This paper is about the role of different microbes in waste water treatment methods in different areas of Jayanti Nala. The important technique Bioremediation gives a strategy to diminution of contamination which is there in waste water. Thus we need to develop a better understanding of microbial communities and how they react to the contaminated environment of waste water for reduction of desired heavy metal. Identifying the right microbe from the waste water which is responsible for reduction of more contributing heavy metal is the major task and carrying out field trials with these identified microbes for bioremediation techniques would definitely provide cost effective technologies and offer potential for significant advances in the Jayanti Nala field. The general heavy metal which is present in waste water are Mn, Ni, Cr, Fe, Zn and Cu. In our samples of waste water Fe is more contributing heavy metal. So we need to find microbes which consume more heavy metal. The ability of desired microbes is also important for carrying out bioremediation technique. Bioremediation is the enormous and vast field, which helps to improve nutrient efficiency in soil as well as water also useful for removal of toxic chemical element. (e.g. Cr metal). There is large scope for developing new technique and finding new organisms within the contaminated sites. This microbe is the main part of this process. It is one of the best pollution free method that can help to achieve our goal of cleaning up Jayanti Nala environment.

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