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Bio Reduction of Industrial waste water Hardness by Bat Guano

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ABSTRACT

Bat guano is an old faecal matter of bat was collected from the old temples located in the rim of Lonar crater of Lonar, Buldana District, Maharashtra (India). It is known for the degradation of pollutants. The sugar factory effluent has the characteristics of hardness due to the presence of Ca^{++} and Mg^{++}. In the present study an attempt has been made to employ the Bat guano to reduce the hardness of the reclaimed water from sugar factory. There was a significant decrease of hardness against controls. There were 10.47, 14.82, 22.63 and 31.88% reduction at the interval of 10, 20, 30, 40 days in the water after application of Bat guano. The results are discussed with hardness pollution reduction. Our investigation indicates that bat guano used for degradation of water pollutants and bioremediation of aquatic ecosystems and also for waste water treatments.

Key words: Bioremediation, Waste water, Lonar crater, Hardness, aquatic ecosystem, Bat guano.

INTRODUCTION

Lonar crater is situated in village Lonar in the Buldhana District of Maharashtra, India. It has an almost perfectly circular shape and accumulated with water in the deeper parts of basin. Rocks in the crater reveal many characteristic features of the moon rocks. There are many old temples on the peripheral boundary of the crater which have now become roosting places for bats. Ramgaya Temple has become the source of sweet drinking water, as this is the only sweet water stream available in the crater; rest of the crater water is highly saline. Kamalja Devi temple is situated at the southern base of the crater. Morache temple (Peafowl's temple) is now famous for existence of thousands of bats and peacocks. Waghache temple (Leopards temple) is also famous for bats and people have seen leopard found in it many times.

BAT GUANO

The word guano originated from the Quichua language of the Inca civilization and means "the droppings of bat". The bats forage at night for insects over a particular area, and they return to the old temples during the day to sleep and care for their young.

They attach themselves to ceiling, and their excrement accumulates on the floor below. In some situations the guano can reach a depth of feet in many years and appeared as guano-hip, and it has a valuable importance.

BIOREMEDIATION AND BAT GUANO

One of the most serious universal, international problems facing us today is the removal of harmful compounds from industrial and municipal as well as anthropogenic waste. If it is discharged into lakes and rivers, a process called eutrophication occurs (Prince, 2003).

Environmental contamination whether it is from industrial or municipal or anthropogenic toxic waste that degrades the various environments is a vital concern to the public. Thus it is crucial to develop and implement accurate means to clean and preserve our precious and deteriorating environment. Although there are many techniques in cleaning environmental contaminations, one process has the most potential, namely bioremediation. Bioremediation, or commonly referred to as biodegradation, is a process in which microbes such as bacteria, fungi, yeast, or micro algae are involved in degrading toxic wastes (Pace, 1997 and Knezevich, 2006).

A marvelous symbiosis exits between the microorganisms and bat guano. Bacteria in the mammalian intestinal tract aid in the breakdown of food during digestion. These organisms synthesize enzymes capable of degrading a vast array of substances. Innumerable microbes are regularly excreted along with waste products and together with other organisms; they constitute the microbial population of a bat guano deposit (Steele, 1989).

Large populations of bat deposit thousands of kilograms of dropping annually. An ounce of bat guano contains billions of bacteria, and a single guano deposit may contain thousands of bacterial species. Guano being rich in bioremediation microbes cleans up toxic substances, (Barry et al., 1997). At present we do not know these species.

MATERIAL METHODS

To study the impact of bat guano on sugar factory effluent, 10 mg bat guano was dissolved in 100 ml of sugar factory effluent (10:100 proportions). After addition of bat guano in sugar factory effluent, the samples were kept undisturbed and analysis was carried out for 40 days at an interval of 10 days for the change in its hardness contents. The change in sugar factory effluent was noted after every 10 days upto 40 days hours. The water was analyzed by using standard methods for water analysis suggested by APHA (1998).

RESULTS & DISCUSSION

When bat guano was dissolved in sugar factory effluent with hardness (47.14), after 10 days the hardness was found to be decreased gradually to (32.11) upto 40 days (Table, 1). The sugar factory effluent was kept undisturbed till 40 days and the hardness was noted after every 10 days upto 40 days. After 40 days the hardness was seen to be remained constant during observations (Table, 1).

All values are the mean of five replicates; values in parenthesis indicates % of reduction; Ps – Parameters; Sg – Sampling; W1 – Control water from sugar factory; W2 – Water from sugar factory.

Tilak et al. (2005) reported a number of bacterial species associated with the bat guano belonging to genera, Azospirillum, Alcaligens, Arthrobacter, Acinetobacter, Bacillus, Burkholderia, Enterobacter, Erwinia, Flavobacterium, Pseudomonas, Rhizobium and Serratia. He also suggested that this bacterium has high bioremediation capacity. Hutchens et al. (2004) had demonstrated aerobic methane oxidizing bacteria, Methylomonas and Methylococcus in bat guano.

Table, 1: Impact of bat guano on sugar factory effluent content at an interval of 10 days.

Ps	Sg	Time (days) and Ca++ content (mg/l)				
		0	**10**	**20**	**30**	**40**
C Hardness	**W1**	47.14 ±1.08	47.14 ±1.03	47.14 ±1.10	47.14 ±1.24	47.14 ±1.32
E Hardness	**W2**	45.20 ±1.45 (4.11)	42.20 ±1.20 (10.47)	40.15 ±1.22 (14.82)	36.47 ±1.05 (22.63)	32.11 ±1.15 (31.88)

The bacterial enzymes capable of degrading a number of substances (Martin, 1991; Dvorak *et al*., 1992; Edenborn *et al.,* 1992; Bechard *et al.,* 1994; White and Chang, 1996; Frank, 2000; Kaksonen, *et al*., 2003; Vallero *et al*., 2003; Boshoff, *et al*., 2004; Miranda, 2005; Seena, 2005; Tilak *et al.,* 2005).

Murphy (1989) demonstrated a nutritious broth formation when the bat guano was added in water and further he proved that this broth supported the growth of numerous microbes.

Alley and Mary (1996) stated that an ounce of bat guano contains billions of bacteria and thousands of bacterial species and these bacteria are important to bioremediation. Sridhar et al. (2006) and Pawar *et al.* (2004) examined the fungal fauna of bat guano and used for bioremediation of Lack soil.

CONCLUSION

Other than municipalities, various industries disposing off the industrial effluents are the worst polluters of the aquatic resources. It is of utmost importance, hence, to prevent the pollution of aquatic resources by all possible means to control its quality from further deterioration. Applying microorganisms for industrial pollution control is an area of interest all over the world.

In the present investigation is an attempt to study the impact of bat guano with its rich microbial flora on bioremediation of industrial effluents. The results revealed that within a period of 40 days, there was a remarkable reduction in the physico-chemical parameters of industrial effluents, thus stabilizing the industrial effluents, suggesting that industrial effluents can be effectively treated by bat guano.

No much work has been carried out on the bat guano in India and hence it was thought to study the impact of bat guano from and to assess the feasibility of the bat guano as supplementary bioremediatant.

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Conflicts of interest: The authors stated that no conflicts of interest.

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