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IMPACT OF BAT GUANO ON DEGRADATION OF WATER POLLUTANTS IN PURNA RIVER IN BULDANA DISTRICT, MS (INDIA)

Bharambe, C. M.
Department Of Zoology
Vidnyan Mahavidyalaya,
Malkapur Dist- Buldana (Ms) 443101.
E-Mail – Iqacvmvmlk@Rediffmail.Com

Swapna S. Patil
Department Of Zoology
Vidnyan Mahavidyalaya,
Malkapur Dist- Buldana (Ms)

ABSTRCT

Bat guano was collected from the temple of Lonar crater of Lonar, Buldana District, Maharashtra. The bat guano, it dissolved in water of Purna River, (10:100) concentration was prepared and kept undisturbed till 30 days and parameters was noted at an interval of 2 hour and thereafter 5 days for about 24 hours and 30 days respectively. Resulted into increasing in pH and decline in chloride, nitrate, phosphate and sulphate content of industrial effluent after the addition of bat guano. Our investigation results indicated that bat guano used for degradation of water pollutants and bioremediation of aquatic ecosystem.

Key words: ***Bioremediation, bat guano, industrial effluents. Water pollutions etc.***

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 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 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 AND METHOD

To study the impact of bat guano on water content of Purna River, 10 mg bat guano was dissolved in 100 ml of experimental water (10:100 proportions) for both times. After addition of bat guano in water, then the water was analyzed for the change in its pH, chloride, nitrate (NO_2), phosphate (PO_4) and sulphate (SO_4) contents. The change in water parameters were noted after every two hour upto 24 hours. Thereafter, the samples were kept undisturbed and analyses were carried out for 30 days at an interval of 5 days. The water was analyzed by using standard methods for water analysis suggested by APHA (1998).

OBSERVATIONS AND RESULTS

When bat guano was dissolved in river water with pH 5.00. After 2 hours the pH was found to be changed to 6.15 and after 4 hours increased gradually and it reached to 7.25 after 24 hours (Table, 1). The river water was kept undisturbed till 30 days and the pH was noted after every 5 days upto 30 days. After 5 days the pH was seen to be increased upto 20 days and then it remained constant during 25 to 30 days of observations (Table, 2).

When bat guano was dissolved in river water with chloride (201); nitrate (56.5); phosphate (57.5) and sulphate (46.0), after 2 hours the parameters was found to be changed to chloride (187), nitrate (52.4), phosphate (56.5) and sulphate (46.0) and after 4 hours decreased gradually to chloride (91), nitrate (24.4), phosphate (29.5) and sulphate (29.6) upto 24 hours (Table, 1). The river water was kept undisturbed till 30 days and the chloride, nitrate, phosphate and sulphate was noted after every 5 days upto 30 days. After 5 days the parameters was seen to be decreased upto 20 days and then it remained constant during 25 to 30 days of observations (Table, 2).

DISCUSSION

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.

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.

CONCLUSIONS

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 aquatic resource from Purna river. The results revealed that within a period of 30 days, there was a remarkable reduction in the physico-chemical parameters of river pollutants, thus stabilizing the river pollutants, suggesting that water pollutants can be effectively treated by bat guano.

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Table, 1: Impact of bat guano on water content of Purna River at an interval of 2 hrs.

Ps	Sg	Time (Hrs)												
		0	2	4	6	8	10	12	14	16	18	20	22	24
pH	W1	5.00	6.15	6.49	6.55	6.65	6.82	6.55	6.84	6.85	7.91	7.95	7.02	7.25
Cl	W1	201	187	173	160	155	143	132	125	115	107	98	93	91
NO2	W1	56.5	52.4	48.8	47.0	44.8	41.5	39.5	29.5	27.8	26.1	25.4	24.8	24.4
PO4	W1	57.5	56.5	55.0	45.0	44.0	43.5	39.5	35.5	32.0	31.5	30.5	29.5	29.5
SO4	W1	46.8	46.0	45.6	44.5	43.8	42.3	39.5	37.2	34.8	33.2	30.5	29.6	29.6

All values are the mean of five replicates; Ps – Parameters; Sg – Sampling; W1 – Water from Purna River.

Table, 2: Impact of bat guano on water content of Purna River at an interval of 5 days.

Ps	Sg	Time (days)							
		0	1	5	10	15	20	25	30
pH	W1	5.00 ±0.37	7.25 ±0.39 (+45.00)	7.42 ±0.24 (+48.40)	7.38 ±0.30 (+47.60)	7.40 ±0.32 (+48.00)	7.43 ±0.40 (+48.60)	7.55 ±0.45 (+51.00)	7.55 ±0.40 (+51.00)
Cl	W1	201 ±7.60	91 ±8.83 (-54.73)	86 ±10.95 (-57.21)	84 ±10.09 (-47.26)	83 ±9.73 (-58.21)	82 ±9.41 (-58.71)	81 ±11.06 (-59.70)	81 ±9.68 (-59.70)
NO2	W1	56.5 ±2.71	24.4 ±1.12 (-56.81)	24.0 ±1.25 (-57.52)	23.6 ±1.49 (-58.23)	23.1 ±1.28 (-58.94)	22.8 ±1.13 (-59.29)	22.2 ±1.29 (-59.29)	22.2 ±1.40 (-59.29)
PO4	W1	57.5 ±3.05	29.5 ±1.68 (-48.70)	27.5 ±1.96 (-47.83)	26.4 ±1.45 (-54.09)	25.3 ±1.29 (-56.00)	23.0 ±1.15 (-60.00)	21.4 ±1.28 (-62.78)	21.4 ±1.20 (-62.78)
SO4	W1	46.8 ±2.48	29.6 ±1.68 (-37.18)	28.9 ±1.59 (-38.25)	28.1 ±1.43 (-39.96)	27.8 ±1.39 (-40.60)	26.9 ±1.61 (-42.52)	26.1 ±1.46 (-44.23)	26.1 ±1.70 (-44.23)

All values are the mean ±SE of five replicates; Figures in parenthesis indicate percent change over the result on 0 day; Ps – Parameters; Sg – Sampling; W1 – Water from Purna river.