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Physico-Chemical Properties of Sediments of Bor River Dam, Near Nandgaon Peth, District Amravati

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ABSTRACT

Bor river dam is situated near Angoda Village and Nandgaon Peth of Amravati District. The purpose of this study was to assess the physico-chemical properties of sediments of dam. The sediment samples were collected from the Bor dam. Physico-chemical analyses of the collected samples were done. The parameters monitored include: pH, Electrical Conductivity, percentage of Organic Matter, Bicarbonate Alkalinity, Available Nitrogen, Available Phosphorus and Available Potassium.

Keywords: *Dregs, catchment, dam sediments, available phosphorus*

INTRODUCTION

Sediment is described as solid particles generated by the disintegration process of organic and inorganic materials (Bortone, 2006). These particles, found in various shapes and sizes, can be transported by water, wind, glaciers, and other natural causes (Montgomery *et al.,* 2000). Sediment deposited in deltas and reservoirs are generally fine-grained (sand, silt, and clay) (Kamarudin *et al.,* 2009; Tigrek and Aras, 2011). The sedimentation process depends on the flow regime and flow rate of the river (Kamarudin *et al.,* 2009). Sediment is an integral part of aquatic ecosystem, providing habitat, feeding, spawning and rearing areas for many aquatic organisms. Protecting sediment quality is an important part of restoring the biological integrity of water bodies as well as protecting aquatic life, wild life and human health (Issa *et al,* 2011). Sediment analysis is increasingly important in evaluating qualities of the total ecosystem of a body of water, in addition to the water sample analysis practiced for years (Pravin *et al.,* 2011).

Natural rivers are considered balanced with respect to sediment and water inflow and outflow. However, when rivers are controlled, especially by the construction of large dams, this balance can be dramatically changed. Dam construction in rivers decreases velocity, causing a sedimentation increase upstream of the dam. This reduces the storage capacity of reservoirs, thus negatively influencing other benefits of large dams, such as water supply, power production, and flood control (Morris and Fan, 1998).

Sedimentation can change geomorphological conditions upstream of reservoir areas. For example, sediments deposited along riverbanks due to reduced flow will narrow the cross-section of a river before it reaches the reservoir, while the accumulated sediments can change the terrain of the bottom of the reservoir (Ryan, 1991; Csiki and Rhoads, 2014). With the increasing anthropogenic pressure on inland fresh water resources because of sewage pollution, soil erosion, agricultural and industrial dumping of waste etc., it become highly important to monitor the sediment quality which ultimately accumulate all of these excessive wastes.

As compared to the usual water testing, sediment testing reflects the long term quality situation which is independent of current inputs (Hodson,1986 and Haslam,1990). Because pollutants are conserved in sediments over long periods of time according to their chemical persistence and the physical-chemical and biochemical characteristics of the substrata. Land use issues, poor catchment management and excessive erosion result in excessive quantities of sediment. Sediment accumulation results in the loss of open water, which is a serious problem in landscape parks and other sites where retaining open water is important. With the sediment come phosphate and nitrate which cause enrichment or eutrophication of the dam and lake, very poor water quality and algal blooms. The sediment acts as a store of phosphorus, which 'leaks 'out into the water, causing long term pollution. (Sediment Management Dredging in Lakes, 2002). The current research aimed to study the physico-chemical properties of sediment and its utility for agriculture.

MATERIAL AND METHODS

The Bor river dam is situated near Angoda Village and 5 km away from Nandgaon Peth of Amravati District. The Bore dam is covered by agriculture land and occupy 304.50 hector area. As the reservoir is fed by Nand river, the water level (controlled) attract a variety of marsh loving birds. In winter, it provides a good habitat for migratory and residential water fowls who visit the area in large numbers. For the analysis purpose, the sediment samples were collected in polythene bags from Bor dam and were transported to laboratory. Physico-chemical characteristics of sediments such as pH, Electrical conductivity, organic matter (%), bicarbonate alkalinity, available phosphorous, available nitrogen and available potassium were studied according to method given by Chemical and biological methods for water pollution studies (Trivedi and Goel, 1986).

RESULTS AND DISCUSSION

The experimental data on physico-chemical properties of sediment samples collected at four different sampling sites from the Bor dam is presented in Table 1. Soil pH is the single soil characteristic, which elucidates an overall picture of the medium for plant growth including nutrient supply trend. The amount of heavy metals mobilized in soil environment is a function of pH, properties of metals, redox conditions, soil chemistry, organic matter content, clay content, cation exchange capacity and other soil properties (Arun and Mukherjee,1998; Kimberly and William, 1999; Sauve *et al.*,2000). Heavy metals are generally more mobile at pH < 7 than at pH >7. The pH of the sediments from the Bor Dam was recorded 7.38 to 7.82; this is

therefore non- hazardous for agricultural purposes. Electrical conductivity is a measure of the current carrying capacity, which is due to the presence of soluble salts in the soil (Rana *et al*., 2009). The electrical conductivity from different spots during study was found in the range 0.523 m mhocm^{-1} to 0.734 m mhocm$^{-1.}$

Soil organic matter is composed of many elements, but carbon and nitrogen are most important. Generally higher levels of carbon and nitrogen are found in colder and wetter soil, where organic matter tends to accumulate. Lesser amounts are found in more intensively weathered soils and in hotter and drier areas, where biomass production is more limited and organic matter breakdown is rapid because of warmer temperature (Henderson, 1995). The organic matter of sediments during study was found in the range of 8.02 % to 9.84 %. The maximum organic matter was found in sample IV, which may be due to the heavy decomposition of various substances as compared to other sites. The total alkalinity of the soil is due to the carbonates and bicarbonates present in it. The dissolution of carbonates and bicarbonates in the soil takes place from the parent weathered rock. The bicarbonate alkalinity of soil from different spots was found in the range 142.4 mg/100g to 178.5 mg/100g. The available phosphorous come from organic matter as probably bound to it. It is well known that organic matter in sediments act as reservoir of nutrients, aids in nutrient holding and binds nutrient thereby preventing them from becoming permanently unavailable. Phosphorus from inorganic sources from the agricultural area in the form of fertilizers and detergents etc. from domestic households is relatively low as compare to the organic sources. Unlike nitrogen and carbon, phosphorous has no gaseous form. Therefore, phosphorous does not cycle out of the system like nitrogen by way of denitrification or carbon by respiration. Thus phosphorous tends to accumulate in the sediments. Once in the sediments, phosphorous is slowly released into the interstitial water as organic material is oxidized (Wondim and Mosa, 2015). The solubility of phosphorus in the soil is controlled by soil pH. In acidic soils, most plant available phosphorus is associated with Fe and Al oxides.

In alkaline soils, most soil phosphorus is associated with the Ca, either absorbed to carbonate minerals or existing as various calcium phosphate minerals, the most common of which is apatite (Soil and Plant analysis council, 1999). The available phosphorus range during study was found between 0.180 mg/100g to 0.281 mg/100g. The larger effect of nitrogen fixers on soil nitrogen is clearly understandable from the perspective of nitrogen inputs. Nitrogen fixation by herbs and shrubs with much lower primary productivity than adjacent or control non-fixing vegetation often produces large increases in the soil production (Woods *et al*., 1992). The available nitrogen content of samples was found in the range of 9.7 mg/100g to 17.3 mg/100g. Potassium in the soil is one of the macronutrient and is essential for plant growth. Plants growing in soils with low levels of potassium (<100 mg/kg) have a greater probability of exhibiting deficiency symptoms than plants growing in soils with higher levels of these elements (Amacher *et al*., 2007). The available potassium during study was found in the range of 1.16 mg/100g to 1.92 mg/100g.

Table1: Physico-chemical parameters of Sediments of Bor Dam

Sr. No.	Parameters	Sample I	Sample II	Sample III	Sample IV
1.	pH	7.63	7.38	7.52	7.82
2.	Electrical Conductivity	0.677 m mho cm^{-1}	0.523 m mho cm^{-1}	0.612 m mho cm^{-1}	0.734 m mho cm^{-1}
3.	Organic Matter	8.59 %	9.10 %	8.02 %	9.84%
4.	Bicarbonate Alkalinity	151.6 mg/100g	142.4 mg/100g	165.5 mg/100g	178.5 mg/100g
5.	Available Phosphorus	0.192mg/100g	0.180 mg/100g	0.243 mg/100g	0.281 mg/100g
6.	Available Nitrogen	9.7 mg/100g	13.3 mg/100g	11.4 mg/100g	17.3 mg/100g
7.	Available Potassium	1.16 mg/100g	1.34 mg/100g	1.41 mg/100g	1.92 mg/100g

CONCLUSION:-

The present study concluded that the concentration of plant nutrients in sediments analyzed to date has been low. The addition of these minerals in sediments may be due to the agriculture runoff. As the sediment has good quality of crop nutrients it can be use in agriculture as manure and it has been suggested that dredged sediment could be used as a soil conditioner in gardens, possibly mixed with other materials and composted.

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