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Study of Some Physiochemical Properties of Soil in Fish Pond at Circuit House, District Sibi of Province Balochistan, Pakistan

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Abstract: A study was conducted to detect some physiochemical properties and metals concentration in soil sample of circuit house Sibi pond, District Sibi of the province Balochistan. Pond soil samples were collected from the fish pond of district Sibi. The soil parameters like soil texture, pH, total dissolve solids (TDS), conductivity and metals concentration were determined. The pH of pond soil was ranged from 9.1 to 9.3 with an average value 9.2, total dissolved solids (TDS) were ranged from 173.3 to175.3mg/L with an average value 174.6mg/L, while electrical conductivity ranged from 289 to 290µs with average value 290µs, respectively. The concentrations of some metals i.e., sodium, potassium, calcium, manganese, iron and chromium in pond soil were found to be 144.5 (Na), 136 (K), 220 (Ca), 4.794 (Mn), 75.91(Fe) and 1.809 (Cr) in mg/kg of soil, respectively. As pond soil provides all the important nutrients with water, therefore, our present study would be helpful to understand the quality of soil in a fish pond and its impact on all aquatic biota found in fish pond.

Key words: SibiDistrict · Pond Soil · Physiochemical Properties of Fish Pond Soil

INTRODUCTION

Sibi is a district in Balochistan province of Pakistan. The population of Sibi is about 64069 according to 2012 survey, located at 29.5448 (latitude), 67.8764 (longitude). It is also known as the "Hot spot"ofPakistanwhere the temperatures in the summer exceed far above normal 52.6 °C (126.7 °F).

The productivity of a pond or lake depends upon the quality of soil as it controls pond bottom stability, pH of overlying water and concentrations of plant nutrients necessary for the growth of phytoplankton. The principal physical conditions such as depth, shore conditions, pressure and movement of water, temperature, turbidity and light are important for aquaculture. Similarly the chemical conditions such as oxygen, carbon dioxide, pH, total hardness of water, nitrates, phosphates, conductivity and heavy metals are important in fish culture. Along with these, productivity of pond also depends upon a large number of planktoncommunities (i.e., zooplankton and phytoplankton) that are living in various zones of the ponds [1]. Therefore, for the good development of fisheries, the right type of plankton is essential. The quality of water in turn depends on the source and kind of soil it traveled over [2]. An aquaculture system is always balanced by pond soil, as the soil properties play a vital role in growth and survival of aquatic organisms. Furthermore, the pond soil can use as a bumper to the aquatic ecosystem and it serves as a biological filter through the adsorption of fish excretions, algal metabolites and organic residues of feed. The major function of pond soil is water maintenance. Soil is used as pond substrate and dyke structure textile. Soil controls pond bottom solidity, pH and salinity. In other terms, it normalizes the overlying water eminence [3].

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The character of a fastidious soil depends on its physical property and nutrient concentration. The physical properties of pond soil depend on the color, texture, porosity, composition consistence, permeability and mineral constituent [4]. Texture of soil refers to the comparative quantity of sand, silt and clay in soil. It is a significant soil parameter since it determines the appropriateness of a location for fish civilization [4]. Soil color gives an indication of the variety of process concerned in the soil. It also indicates the attendance of various mineral deposits present in the soil. The red color is due to accrual of decaying natural matter [4]. Soils are formed by the weather of rock or materials deposited by rivers or storm. Five significant factors are accountable for the type and degree of soil growth. These are climate, organisms, parent substance geography and instance [5]. Porosity is the proportion of the volume of void to the total volume of the soil aggregate the volume of voids refers to that segment of the volume of soil not engaged by mineral grains. Permeability is the rate at which water or gases passes through a cylindrical segment of center. The co-efficient of permeability is calculated using a stable head perimeter and is expressed in centimeter per seconds.

Nutrients are classified into three major groups: 1) Main nutrients consisting of: nitrogen, phosphorus and potassium;2) Minor nutrients consisting of calcium, magnesium and sodium; and 3) micronutrients consisting of: cobalt, copper, manganese and zinc. The primary and secondary nutrients are the most significant because their shortage in fishpond soil, lower the production of the pond. Secondary nutrients are referred to as transferable cations (Ca^{2+}, Mg^{2+}, Na^{+}). These cations are extract from soil by agitate with ammonium hydroxide (NH_4OH). The absorption level of each cation in the extract was determined by using Atomic Absorption Spectrophotometer or flame photometry [6].

MATERIALS AND METHODS

Soil Samples Collection: Soilsamples were collectedfrom six places at the bottom of Circuit house pond of Sibi district during the survey at 20thSeptember 2014and then soils were separately mixed to get a composite sample of 2.0 kgfollowed by Devi Priyamvada*et al.*[7] method. It was then put in tight polyethylene bags and shifted to the laboratory. In the laboratory,sample was oven dried at 60°C, broken into smaller size particles with mortar and pestle and sieved through a 2.0 mm sieve.

Analysis of Pond Soil Sample: In the present study, soil sample was analyzed with respect to color, plasticity, texture, pH, total dissolve solids, electrical conductivity and metals concentrations.Color of soil show one of the quality of carbon concentration, climate soil drainage and soil mineralogy. The present soil of the fish pond was brown in Color. The brown Color of soil show drained and capacity of holding nutrients. Soil sample was also slightly plastic and sticky in nature. Browncolorof soil exhibits the behavior of small clay soils and they have a water holding capacity. It is a store house of nutrients, therefore more appropriate for aquaculture.

Soil Texture: Soil texture was determined by Munsiri*et al*. [8] method.

Conductivity and Total Dissolve Solids (TDS) of Soil: Soil sample was analyzed by Conductivity meter JENWAY model no.4520. Conductivity meter calibrated by 0.1 KCl (potassium chloride) solutions and washed electrode of conductivity meter with distal water and dried. Now electrode dipped in pond soil solution and checked conductivity of pond soil solution and also checked TDS of pond soil solution.

Soil PH: pH meter JENWAY model no.3505 calibrated with Buffer solution of 4 and 10 pH. Now pH meter electrodes were washed with distal water dried and dipped pH electrode in pond soil sample.

Metals Analysis: For assessment of metals,soil sample was oven dried and grind in a mortar pestle and sieved up to 0.5 mm mesh by sieve and wet digestion method applied for digestion and then metals in this digested sample were analyzed by atomic absorption spectrophotometer.

RESULTS AND DISCUSSIONS

In the present study, some physicochemical parameters of soil including soil texture, soil pH, Total dissolve solids (TDS), electrical conductivity and metals concentration i.e., sodium, potassium, calcium, manganese, iron and chromium from selected culture pond of circuit house of Sibi district were analyzed, as shown in Tables 1-2 and Figure 1, respectively.

Table 1: Showing texture and the percentage of soil particles collected from the fish pond at Circuit house of district Sibi

Pond location	Pond area	Sand %	Silt %	Clay %	Texture
Circuit house, district Sibi	10800 meter square	52-55%	28-30%	10-14%	Sandy loam

Table 2: pH, electrical conductivity and salinity of circuit house pond soil sample

	pH of soil			Electrical conductivity (EC) in µs			Total dissolve solids (TDS) in mg/L		
Pond location	Min.	Max.	Mean±S.D	Min.	Max.	Mean±S.D	Min.	Max.	Mean±S.D
Circuit house fish Pond at Sibi district.	9.1	9.3	9.2±0.082	289	290	290±0.081	173.3	175.3	174.6±0.082

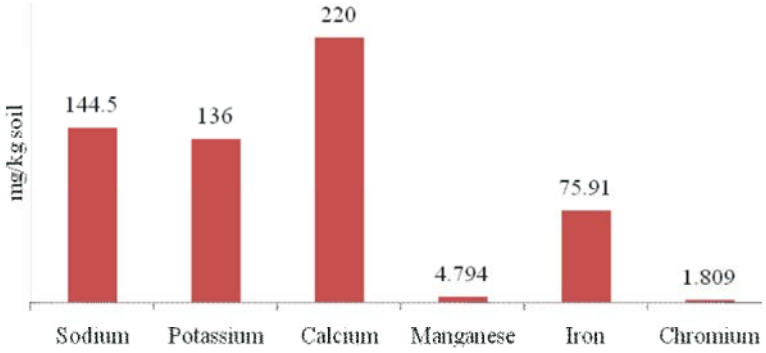

Fig. 1: Concentration of some metals in circuit house pond soil sample

Soil Texture: As the particle size division in soil is known as soil texture, therefore, a soil texture can be name with percentages of clay, silt and sand found in it. In the current study, 2-years aged pond contained 52-55 % of sand, 28-30 % of silt and 10-14 % clay that might be consider as sandy loam soil, which was in agreement with Siddique*et al*. [9], as shown in Table 1. Ahmed [10] had been reported that sandy loam type soil is most appropriate for aquaculture in fish ponds of Bangladesh. Therefore, it can be observed that the bottom soil of district Sibi circuit house pond was found to be favorable for fish culture practices.

PH of Pond Soil Samples: The pH of pond soil samples were ranged from 9.1 to 9.3 (Table 2), with an average value 9.2, hence, the soil pH is alkaline. A high alkaline condition was observed in the present study and furthermore, 50% pond was unproductive, only 25 % was productive. As, the optimum pH of soil for fish production is ranged from 6.5 to 7.3, therefore, from the above observation, it had been concluded that highly alkaline condition of pond soil is undesirable for production of fish as reported by Ahmed [10].

Electrical Conductivity: Electrical conductivity determines that a solution can conduct electricity and it is associated with the salt concentration. Electrical conductivity of soil sample in of this study was ranged from 289 to 290µs (Table 2), with average value 290µs. Hence, electrical conductivity of circuit house pond soil sample was in the favored range.

Total Dissolved Solids (TDS): Salinity of soil is necessary for the fish strength and it increases the natural slim coating. Soil salinity can fight against fungus and also kill mainly parasitic infestations. In present study, total dissolve solids of soil sample in range from 173.3 to 175.3mg/L with an average value 174.6mg/L(Table 2).

Metal Analysis: The concentrations of some metals in pond soil analyzed in this study were found to be like sodium 144.5 mg/kg, potassium 136 mg/kg, calcium 220 mg/kg, Manganese 4.794 mg/kg, Iron 75.91 mg/kg and Chromium 1.809 mg/kg as shown in Figure 1, respectively.

Soil quality of pond bottom is a key factor in the success of fish culture, especially during semi-intensive and intensive fish culture systems [9]. Pond soil may also function as a buffer for the aquatic ecosystem, because it provides all essential dissolve nutrients in water, serves as a biological filter through the adsorption of the organic deposits of food, excreta of fish and other animals that settle down to the bottom of pond [11].

CONCLUSION

Our results showed that parameters of soil such as texture, pH, EC, salinity and metals more or less similar to the standard value for aquaculture activity in district Sibi Circuit house pond. Community view is also more or less related to the analysis. Considering result of soil analysis it may be recommended that soil characteristics in the Circuit house pond seem to be appropriate for growth of aquaculture. From the above discussion it had been be concluded that if proper management strategies will not be developed than the aquaculture will be successfully developed in Pakistan.

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