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Some Physico-chemical Parameters of Soil and Water of Sundarban Mangrove Forest, Bangladesh

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Abstract: An attempted has been made to know the condition of soil and water of the Sundarban mangrove forest of Bangladesh by applying standard method. Soil pH was varied from 6.3 to 7.13. Organic matter of soil was found 7.63, 6.73, 6.67 and 6.67 at Sharankhola, Chandpai, Nalianala and Buigoalini, respectively. The average percentages of carbonate content in the soil were varied 12.33-17.13. The soil of Oligohaline zone of Sundarban mangrove forest is rich in calcium followed by magnesium and then potassium. The percentages of silt and clay were higher than sand in all study areas. The conductivity of water was found 270, 300, 7800 and 12300 (Micromhos/cm) in the river Rupsha, Passure, Shipsa and Arpangasia, respectively. Dissolved chloride in the water was found 200, 550, 2800 and 7200 (mg L⁻¹) in the river Rupsha, Passure, Shipsa and Arpangasia, respectively.

Key words: Soil and water, Sundarban, Bangladesh

INTRODUCTION

Sundarban is the largest single block of tidal halophytic mangrove forest in the world, located in the southern part of Bangladesh (Latitudes 21°30'N and 22°30'N Longitudes 89°00'E and 90°E). The forest has a total area of 571,508 ha, of which 169,903 ha consists of about 400 tidal rivers, canals and others sources. Out of a land area 401,600 ha; 395,500 ha with 200 Island occupied by forest of various plant species^[1]. The low-lying areas are dominated by a network of small creeks, which flow into the main water source during the ebb-flow of the tide. The coast of the Sundarban is criss-crossed by a network of complex estuarine system created by the river Rupsha, Passur, Shipsa, Arpangasia and others river which open into the Bay of Bengal through the Sundarban Reserved Forest (SRF) and carry large amounts of nutrients which facilitate the productivity in the area. The SRF has also been famous for diverse plants, wildlife, reptiles, fishes and birds. The entire resource of SRF is under SRF authority.

The coastal mangrove forest habitats are considered to be the most productive of all natural habitats of the world, especially for fisheries resources. The plant and vegetation of SRF provide food and shelter for fish, crustaceans, mollusks and others aquatic lives. The entire Sundarban and its surrounding areas of brackish and marine water are used as breeding, nursery and feeding

habitats by varieties of fishes, mollusks and crustaceans. The resident migratory fishes, post larvae and juvenile of fishes, shrimps and prawns constitute the SRF fishery.

Fishing is more or less continuous process inside and outside the forest at sea, called marine zone where the fishing season is from October to end of February when fishermen come from Chittagong, Cox's bazar, Bagherhat, Khulna, Satkhira and Pirojpur district for fishing. The fishermen built temporary campus or hut in the char (Island) of SRF called Dubla and conduct fishing; marketing and drying activities^[2]. On the char, fishermen do not have any permanent establishment. This fishery is known as the Dubla Char winter fishery, an integrated part of the inshore and offshore marine fishes. Though it is an important forest for its plants, animals and mangrove fishery but there is limited information regarding its soil and water condition. So, the present study has been undertaken to know the some physico-chemical parameters of soil and water of Sundarban mangrove forest.

MATERIALS AND METHODS

Sampling area: Soil and water samples were collected from four different stations of Sundarbans. These are, I. Sharankhola (Oligohaline zone), II. Chandpai area (Mesohaline zone), III. Nalianala area (Mesohaline zone) and IV. Buigoalini area (Polyhaline zone) of Sundarban.

Data collection: Soil samples were collected from three different places of each site and water samples were collected from the river Rupsha, Passur, Shippa and Arpangasia during 15 to 30 Nov. of the year 2002.

Data analysis: Soil pH was measured by Kelway Soil Acidity and Moisture Tester (Model HB-II). Organic carbon was determined by the procedure described by Bouyoucos^[3]. Organic matter was determined by multiplying the value of organic carbon by 1.72. Content of carbonate was determined by the procedures described by APHA^[4]. Na and K were recorded by the method of Aitken^[5]. Some of the moles like Ca and Mg were determined by atomic absorption spectrophotometer. Textural class of soil was determined by according to the International pipette method describe by Piper^[6] and also Hydrometer method^[3]. Water sample were analyzed according to standard method of APHA^[4]. All the determinations were replicated thrice and the mean values were used to obtain representation of each station.

RESULTS AND DISCUSSION

Soil pH: The average pH values were found 6.3, 6.73, 7.13 and 6.8 in the Sharankhola, Chandpai, Nalianala and Burigoalini, respectively (Fig. 1). It is found that Nalianala area is partially alkaline and the other three areas are very weakly acidic. Hassan and Razzaque^[7] found that the pH value of soil in Sundarban is neutral to mildly alkaline under field conditions but in some localities the pH value of dried up sub soil samples drops to 6.5. Mahmood and Saikat^[8] reported the acidic pH values in the soil of Chakaria Sundarban area and consequently, this area has a rich reserve of pyrite in its soil.

Organic matter: The average percentage of organic matter was found 7.63, 6.73, 6.67 and 6.67 at Sharankhola, Chandpai, Nalianala and Buigoalini, respectively (Fig. 1). It is mentionable that the percentage of organic matter is more or less same at Chandpai, Nalianala and Buigoalini. But the Sharankhola area belong high percentage of organic matter than the other three areas (Fig. 1). Five % organic matter is ideal for the proper composition of soil. Choudhury^[9] mentioned that the organic matter in mangrove soil belong over 5%. Due to more decomposition of plant and animal residues in mangrove area the percentage of organic matter is higher than other soil tract. For this reason the biological activity in mangrove forest area is highly active. Zafar *et al.*^[10] stated that organic matter varied between 0.86 and 1.9% in the intertidal muddy beach of Bankhali river. Escourt^[11],

Anderson^[12] and Mayer *et al.*^[13] reported that organic carbon is related to mud percentage in the soil. Mud percentage in the study areas were higher than sand and that is why organic matter was higher in the Sundarban areas.

Content of carbonate: The average percentages of carbonate content were found 15.33, 17.13, 13.0 and 12.33 at Sharankhola, Chandpai, Nalianala and Buigoalini, respectively (Fig. 1). Highest carbon content was observed in the Chandpai range in comparison to other three areas (Fig. 1). Due to more decomposition of plant and animal residue the soil of the Sundarbans belong high content of carbonate. As a result, the color of soil in Sundarban is likely black.

Soil nutrient content

Sodium (Na): Sodium content in the soil is varied from 350 to 2000 $\mu\text{g g}^{-1}$ in the study area (Table-1). The concentration of sodium in Burigoalini area is higher than the other three sites of the study area (Table-1). Karim^[14] reported the sodium (Na) content is varied from 450 to 1850 $\mu\text{g g}^{-1}$ in the mangrove areas.

Potassium (K): Potassium content was observed 250 to 750 $\mu\text{g g}^{-1}$ in the study areas (Table 1). Potassium is almost same or equal except Sharankhola e.g. the range of Potassium content in Sharankhola is 450-750 $\mu\text{g g}^{-1}$ (Table 1).

Table 1: Parameters of Soil nutrients in Sundarban mangrove forest
Major elements ($\mu\text{g g}^{-1}$)

Site/area	Na	K	Ca	Mg
Sharankhola	350-450	450-750	3000-4500	420-750
Chandpai	550-800	250-450	2500-3000	750-900
Nalianala	750-900	350-500	2600-3500	700-850
Burigoalini	1800-2000	370-570	1900-2900	1000-1500

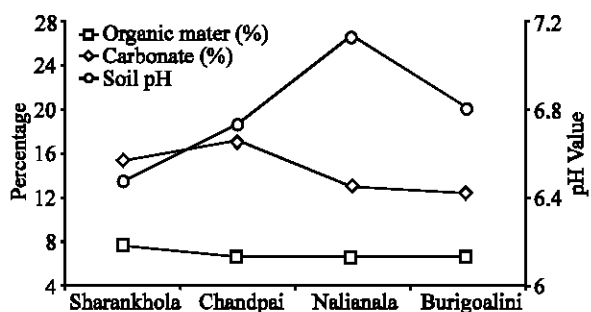


Fig. 1: pH, organic matter and carbonate in different regions of Sundarban mangrove forest

Calcium (Ca): Calcium content in the soil was varied from 1900 to 4500 $\mu\text{g g}^{-1}$ in the study area (Table 1). Distribution of available calcium in the study area is not uniform. The calcium content in Sharankhola and Chandpai areas were higher than Nalianala and Burigoalini (Table 1). Karim^[14] found the calcium (Ca) content was 2350 to 3950 $\mu\text{g g}^{-1}$ in the Sundarban.

Magnesium (Mg): Magnesium content in the soil is varied from 420 to 1500 $\mu\text{g g}^{-1}$ in the study area (Table 1). Magnesium content is almost same or equal except Burigoalini e.g. the range of potassium content in Burigoalini is 1000-1500 $\mu\text{g g}^{-1}$ (Table 1).

Physical properties of soil

Sand: The average percentage of coarse sand were found 9.67, 8.0, 6.5, 6.0 and fine sand 12.83, 14.17, 13.17, 12.0 at the Sharankhola, Chandpai, Nalianala and Buigoalini, respectively (Fig. 2). So, the percentages of sand (sum of coarse and fine sand) were more or less same in Sundarban.

Silt: The average percentages of silt were found 35.0, 33.67, 28.83 and 26.0 at Sharankhola, Chandpai, Nalianala and Buigoalini, respectively (Fig. 2). The average percentage of silt at Sharankhola and Chandpai were higher than the Nalianala and Buigoalini. So the east side of Sundarban e.g. Sharankhola and Chandpai is silty than the west e.g. Nalianala and Buigoalini. Oligohaline and Mesohaline zone are flooded through the river Passur and its branches thus these areas are silty.

Clay: The average percentage of clay has found 25.3, 24.5, 30.33 and 36.5 at Sharankhola, Chandpai, Nalianala and Buigoalini, respectively (Fig. 2). The average percentage of clay at Sharankhola and Chandpai was less than the Nalianala and Buigoalini. So it is found that the soil texture of the Sundarban is likely silty-clay. Choudhury^[9] found that the soil of Sundarban is finely textured and the sub soil is stratified and at greater depth is compacted. Zafar *et al.*^[15] reported that the percentage composition of soil in the Chakaria Sundarban areas were always found to be sand>clay>silt.

Water conductivity: The conductivity of water was found 270, 300, 7800 and 12300 (Micromhos/cm) in the river Rupsha, Passure, Shipsa and Arpangasia, respectively (Table 2). Due to less current in winter session (November) water conductivity of the River Rupsha and Passure is lower than the river of Shipsa and Arpangasia.

Dissolved chloride: Dissolved chloride in the water was found 200, 550, 2800 and 7200 (mg L⁻¹) in the river

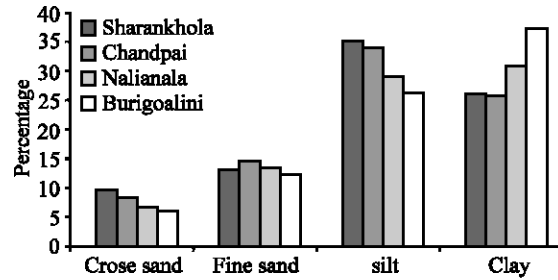


Fig. 2: Percentage of sand, slit and clay in different areas of suhdarban mangrove forest

Table 2: Variations of electrical conductivity and chloride in the river water of Sundarban mangrove forest

River	Location	Conductivity (Micromhos/cm)	Chloride MG L ⁻¹
Rupsha	Khulna	270	200
Passur	Mongla	300	550
Shipsa	Nalianala	7800	2800
Arpangasia	Buigoalini	12300	7200

Rupsha, Passure, Shipsa and Arpangasia, respectively (Table 2). There is also simultaneously found that the dissolved chloride in the river Rupsha and Passure is lower than the river Shipsa and Arpangasia (Table 2). Islam^[16] reported the range of dissolved chloride vary with climatic session.

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