Assessment of Physicochemical Parameters of Sediment from Brahmaputra River

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Abstract

Pollution arising due to different anthropogenic activities is a major concern. Physical and chemical properties of river sediment are influenced by different anthropogenic activities. In the present study the samples were analysed for different physicochemical parameters using standard methods. The sediment particle size distribution indicates higher proportion of sand (sand > silt>clay). It was observed that the pH of the soils was slightly basic, ranging from 7.02-7.57. Organic carbon has a lower value ranged from 0.04-0.25%. Electrical conductivity ranged from 0.15-0.25 dSm^{-1}, chloride content ranged from77.80-96.50 mg/kg and nitrate 3.17-5.38 mg/kg .Concentration of metals were found variable. The observed result indicated that the physicochemical properties of the sediments from the study area are not influenced by anthropogenic activities.

***Keywords*: Brahmaputra River, Sediment, Physicochemical parameters, Organic carbon.**

Introduction

River acts as good drainage system to carry different type of pollutants ultimately absorbed by sediment. Sediments are the slack sand, silt and other particles of soil that settle down at the bottom of a body of water (USEPA, 2002) Sediment is found at the bottom of water body and plays essential role in the aquatic ecosystem (Seiyaboh et al., 2017). Sediment acts as indicator of quality of overlying water and study of it is a useful technique to assess the pollution status of environment (Satheeshkumar and Khan, 2009). Sediments also serve as reservoir of pollutants and therefore the potential source of pollutants to the water column, organisms and ultimately human. Sediment is an integral component of an aquatic ecosystem which provide habitat, feeding and spawning areas for many aquatic organisms (Adesuyi et al., 2016). Contaminated sediments can have harmful effect in benthic and other sediment associated organisms (USEPA, 2001). Most of our water resources are becoming polluted gradually due to the addition of undesired materials from the surroundings (Akan et al., 2012). Sediment input may impact stream communities through various direct and indirect processes including smothering, reduced light penetration, habitat reduction and introduction of absorbed pollutants such as pesticides, metals, nutrients. The structure of sediments in the intertidal zone plays a vital role in the distribution of living organisms on them (Ikomi et al., 2005). Sediments serve as an important depot for the benthic macro invertebrates whose metabolic actions contribute to aquatic productivity (Adesuyi et al., 2016). Sediments are also the main sites for organic matter decomposition which are largely carried out by bacteria. Important macro-nutrients such as phosphorous and nitrogen are being continuously interchanged between sediment and overlying water (Abowei and Sikoki, 2005). The physicochemical parameters of sediments such as salinity, pH, organic carbon and dissolved oxygen can also influence the occurrence and abundance of species on them.Sediment pH is an important factor that controls the nutrient availability. Organic carbon is directly related to mud percentage in sediment. The amount of organic carbon in sediment is largely influenced by both biological and physical factors which in turn influence availability and quality of food sources for benthic faunal communities. Organic micro pollutants are mainly associated with the organic component of the suspended matter, which commonly measured as organic carbon (USEPA, 2001). Bottom sediments have the ability to reload the water column with nutrients through decomposition of organic matter present in the sediment (Avramidis et al., 2013). Organic carbon of sediment has a great role in keeping fertility of soil and thereby raising the biological activity (Kumar, 1996; Satheeshkumar and Khan, 2009). Total organic carbon measures the amount of organic matter conserved within the sediment. The amount of sediment nutrients is estimated as total nitrogen and total phosphorus coming from inorganic and organic sources. Breakdown of organic matter reduces sediment carbon, while concentrated nutrients and dissolved nutrients are released to the water column from the sediment (Froelich et al., 1979). The environmental quality of water and the associate components of an aquatic ecosystem cannot be evaluated without the characteristics study of bottom sediment (Avramidis et al., 2013)

Material and Methods

Study Area: Ten different sampling points from the riverbed were selected in the direction of water flow from both sides of river Brahmaputra in Goalpara district of Assam. The geographical location of the area in between $26^0/6/$ to$26^013/$ N latitude and $90^014/$ to $90^058/$E longitude as shown in Fig-1.

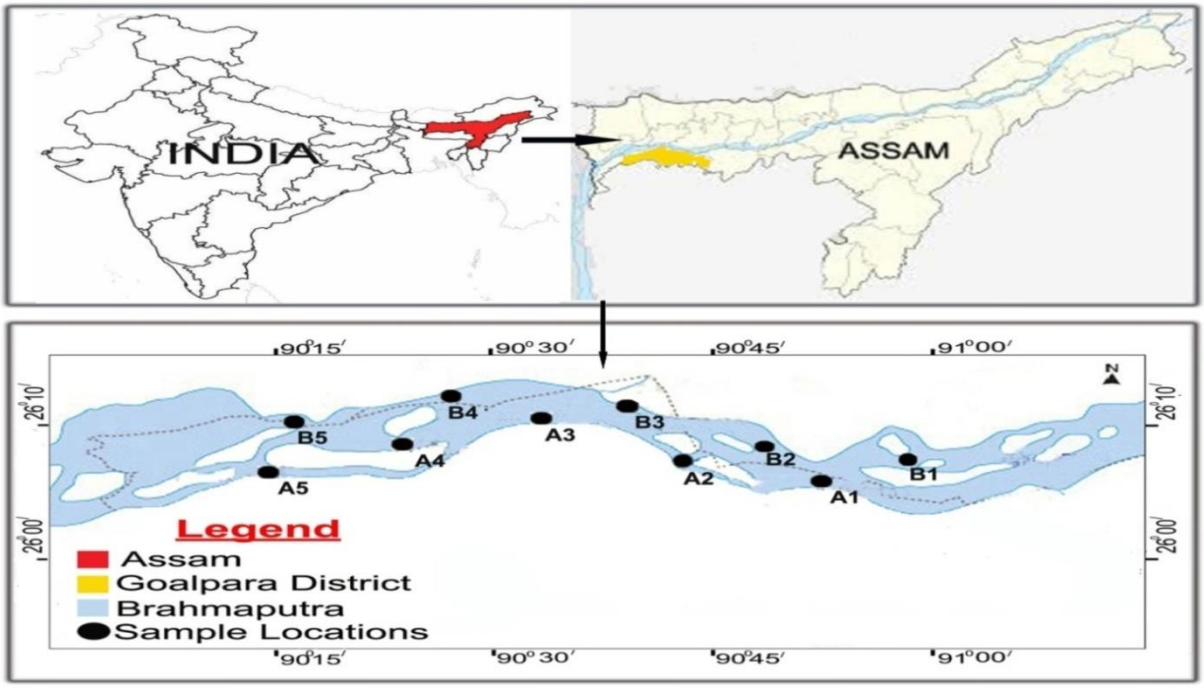

Fig.-1: Map of the study area

Sampling and Analysis: Twenty homogeneous spots were selected from each of the above mentioned sites and soils were collected from a depth of 0-15cm with a plastic hand trowel, mixed roughly to obtain a gross sample. The soil samples were then dried in air and sieved through 2mm sieve. The gross samples were then reduced to 1kg in mass by quartering process (Singh et al., 2000). These are then stored in tight plastic containers for analysis.

Measurement of Physicochemical Parameters: A total of 13 physicochemical parameters such as pH, Bulk Density (BD), Porosity, Electrical Conductivity (EC), Total Organic Carbon (TOC) etc. were determined. Parameters such as pH, EC were measured by the wet sample.TOC in percentage was determined by the titration method of Walkey and Black (1934). pH was determined using digital pH meter. Electrical Conductivity (EC) was determined using conductometer. Soil texture class was determined by Bouyoucos hydrometer method (1962). Hydraulic Conductivity (HC) by Bower and Jackson method. Nitrate (NO_3) levels were determined by Colorimetric method.

Results and Discussion

The values of different physicochemical parameters found in the sediments of river Brahmaputra at different sampling sites are given in table-1 and table-2.

Table-1: Soil texture of river Brahmaputra

Sampling Sites	Sand %	Silt %	Clay %	Texture
A1	92.00	3.35	4.65	Sand
A2	93.40	4.25	2.35	Sand
A3	98.60	0.90	0.50	Sand
A4	93.60	4.10	2.30	Sand
A5	91.00	6.44	2.56	Sand
B1	95.12	2.75	2.13	Sand
B2	94.52	3.55	1.93	Sand
B3	95.20	2.64	2.16	Sand
B4	96.21	2.14	1.65	Sand
B5	94.17	3.21	2.62	Sand

Table-2: Physicochemical Parameters of Sediment of river Brahmaputra

Parameters	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5
BD(g/cc)	1.44	1.45	1.43	1.45	1.46	1.41	1.42	1.48	1.46	1.45
Porosity %	43.87	44.23	45.00	44.46	43.85	44.21	43.72	44.18	43.91	45.12
EC (dSm^{-1})	0.17	0.19	0.16	0.18	0.25	0.17	0.23	0.19	0.22	0.15
HC(10^{-3}cm/S)	8.75	9.88	12.87	6.32	3.93	9.06	10.18	8.34	8.86	9.42
pH	7.02	7.12	7.37	7.04	7.42	7.16	7.57	7.35	7.24	7.45
TOC (%)	0.08	0.04	0.16	0.18	0.25	0.09	0.14	0.07	0.15	0.21
Na(mg/kg)	38.50	67.50	32.50	36.40	38.70	40.30	36.80	32.30	37.90	41.30
K(mg/kg)	20.40	22.50	16.25	18.70	25.00	22.30	23.10	18.30	20.70	19.80
Mg(mg/kg)	8.30	11.20	7.43	9.40	17.00	9.10	10.30	9.60	17.20	9.70
Ca(mg/kg)	9.20	12.00	8.00	8.20	8.00	9.70	9.40	10.30	8.50	9.20
NO_3^-(mg/kg)	3.57	3.85	3.17	4.12	5.38	3.92	4.43	3.75	4.82	3.56
Cl^-(mg/kg)	92.10	78.10	96.50	89.30	92.30	82.80	87.40	84.60	90.40	77.80

[Data expressed as mean values]

Texture: The soil samples were fractioned into sand, slit and clay. The range of sand content in the sediment was found 91.00 % to 98.60%. The range of slit content in the sediment was found 0.90 to6.44%. The clay contents in the sediment ranging from 0.50% to4.65%. The texture of the sediment in all sampling sites was found sandy.

pH and Electrical Conductivity: Soil characterized into acidic, basic or neutral, according to its reaction. pH of the sediment influenced by the response of absorption different nitrogenous fertilizer ,transformation of soluble phosphate, releases of different nutrients at the soil water interface and bacterial activity in soil. pH value of the analyzed sediment sample ranging from7.02 to7.57. The soil is slightly basic in nature. The lower value of pH was observed at sampling site A1 and highest was at sampling site B2.

EC measures the amount of soluble salt present in soil and depends upon on dilution of soil solution. The EC values found 0.15 to0.25 dSm^{-1}. The lowest value of EC was recorded at sampling site B5 and highest was at sampling siteA5.

Total Organic Carbon: Total organic carbon is the index of carbon content in soil and the most important component of soil. Carbon content of the soil controls bacterial activity (Mahajan and Billore, 2014). The soil organic carbon is formed by decomposition of animals, plants and anthropogenic sources like chemical contaminants and organic rich waste (Edori and Iyama, 2017). TOC values were recorded in between 0.04 to 0.25%. The lowest value was found at sampling site A2 and highest was at sampling site A5.

Bulk density and Porosity: The bulk density (BD) indicates the degree of compactness of soil which decreases with increase in organic matter. Bulk density of studied area varied from 1.41to1.48g/cc. The lowest value of bulk density at site B1 and highest was at B3.The porosity of the soil ranged from 43.72to 45.12%. The lowest value of porosity was detected at sampling site B2and highest was at sampling site B5.

Hydraulic Conductivity: The saturated hydraulic conductivity depends upon pore size and clay content of soil. The hydraulic conductivity values range from 3.93×10^{-3}to12.87×10^{-3}cm/S. The lowest value of HC was detected at sampling site A5 and highest was at sampling site A3.

Chloride: Chlorine exists in the soluble form of chlorides in the soil and is strongly associated with organic matter or minerals. It has the tendency to forms compounds with sodium, magnesium and calcium (Edori and Iyama, 2017). The chloride contents of the sediment ranged from77.80 to 96.50 mg/kg. The lowest value was recorded at sampling site B5 and highest was at sampling site A3.

Soil Nutrients: The values of Na contents found in the range of 32.3 to 67.5 mg/kg. The lowest value was found at sampling site B3 and highest was at sampling site A2. The values of K contents found in the range of 16.25 to 25.00mg/kg, with a lowest value at sampling site A3 and highest at sampling site A5.The Mg contents of the sediment varied between 7.43 to 17.2mg/kg, with a lowest value at sampling site A3 and highest at sampling site B4. The values of Ca contents varied between 8.00 to 12.00mg/kg, with a lowest value at sampling site A3 and highest at sampling site A2.

Conclusion

Physicochemical analysis of present study shows different values of various parameters at different sampling sides. Thirteen physicochemical parameters were analysed for the study and the nature of the soil was found slightly alkaline. Soil texture class was in the order of sand>slit>clay. The lower value of organic carbon was found in all stations. Irregular distribution of metals was recorded in the present study.

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