

Seasonal Variation of Different Biologically Significant ion Concentrations of the Jalangi River water

Monojit Ray

Abstract

Biodiversity of a river depends on the variation of nutrients, physico-chemical parameters and different biologically significant ion concentrations of the river water. Seasonal variation of nine biologically significant ion concentrations of Jalangi river water are reported in this article, month-wise, from April 2014 to March 2015. These ions, namely sodium, potassium, magnesium, calcium, carbonate, bicarbonate, nitrate, phosphate and chloride play vital role on the growth of aquatic flora and fauna present in the river. The average concentrations of arsenic(III), sulphate ion, fluoride ion, ferric ion and lead ions are also reported in this paper though they are less significant. These data clearly helps to understand the background scenario of the river's ecosystem.

Keywords: Jalangi; Ion Concentrations; Biodiversity.

Introduction

River ecosystem is moving-water ecosystem. For such an ecosystem land-water interaction is very significant as water current and turbulence are present. These affect the biotic community of the river directly or indirectly. The flow of biologically significant ions within a river ecosystem greatly depends on the concentrations of these ions in the river water.

Sodium, potassium, magnesium and calcium are the most important metals for living systems. They are called bulk metals. Magnesium (II) ion is the absolute requirement for photosynthetic pigments. Calcium get precipitated as calcium carbonate within river. High temperature and high salinity of river water favors calcium carbonate precipitation as, the high evaporation rate and reduced quantity of free carbon dioxide in water can also be observed at high temperature only.

Some bacteria satisfy their nitrogen requirements through reduction of nitrate ions within river water. Carbonate and bicarbonate ions are responsible for effective buffering action of river water. For the aquatic flora and fauna, sufficient phosphates are required for phosphorylation and energy storage. Seasonal variation of these ions have profound influence on the seasonal abundance of different aquatic flora and fauna in the river water. The amount of sulphate,

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arsenite, fluoride, ferrous ion and lead(II) ions do not vary too much, with the change of seasons, round the year. Fluoride is a trace element. Sulphate is important as sulphur is a bulk element. Iron is also a trace metal and biologically significant. Ferrous ions play important role with respect to redox, catalysis, electron transfer, oxygen transfer and storage with in living systems.

Materials and Methods

The Jalangi river water samples were collected from ten sampling sites, namely Jitpur, Taranipur, Chapra, Haranagar, Anandanagar, Ghurni, Krishnanagar kadamtala ghat, PWD more (Rail Bridge), Char-sambhunagar, Hulorghat(Mayapur). Water samples were collected from different depths of sampling sites, up to 8-10 ft depth of the river Jalangi by expert swimmers. The analysis of the water samples were

done using titrimetric methods, flame photometric methods, spectrophotometric methods etc. The analysis of the water samples were carried out in the Department of Chemistry lab of Nabadwip Vidyasagar College. Some analysis were performed

in outside laboratory (Scientific Research Laboratory, Santoshpur, Kolkata). Water sample collections from sampling sites were a continuous process and done using hired boat services from the above mentioned sampling sites.

Analytical Results

Table 1: Variation of Biologically Significant Ion Concentrations of the river Jalangi

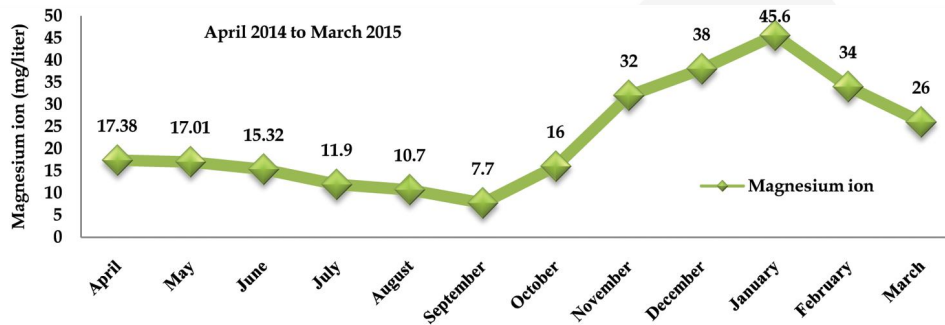


Fig. 2:

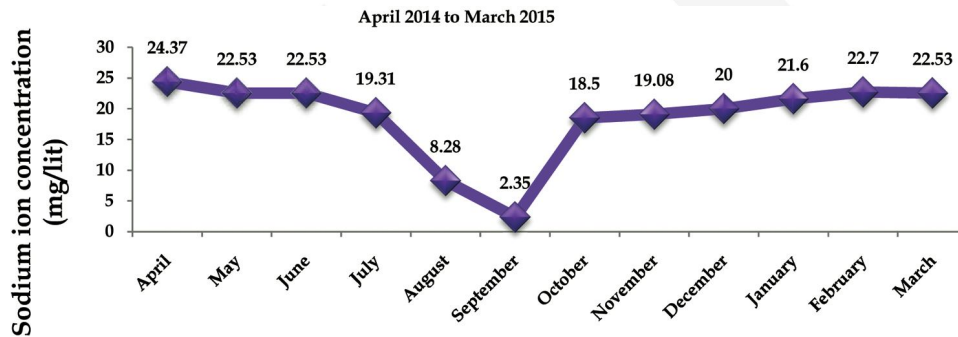


Fig. 3:

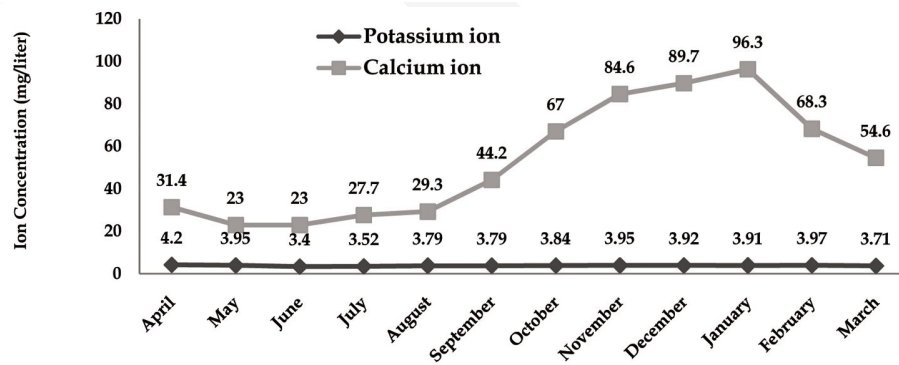


Fig. 4:

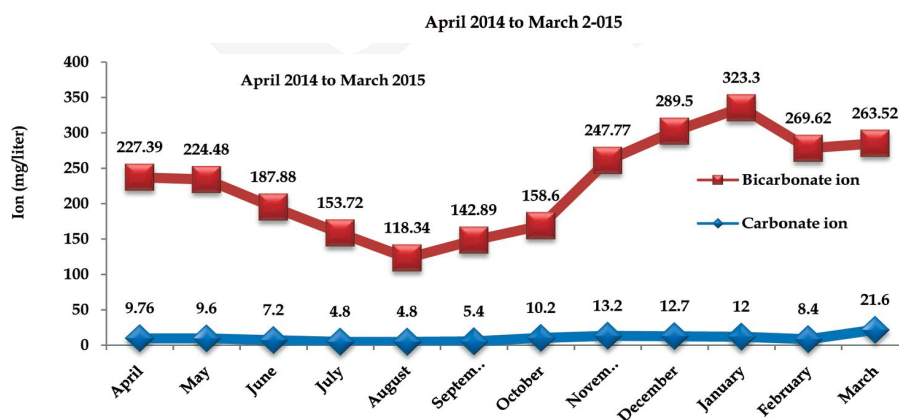


Fig. 5:

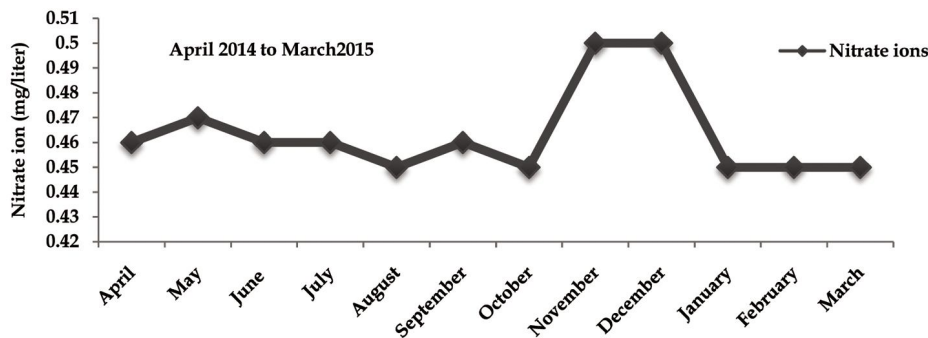


Fig. 6:

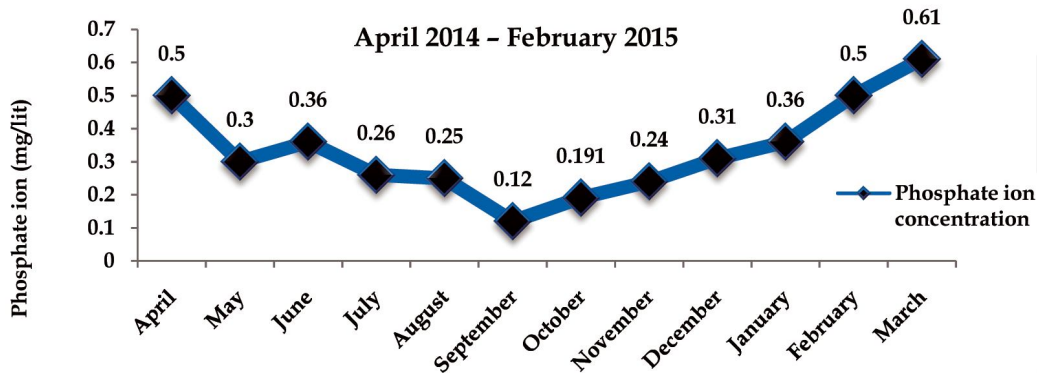


Fig. 7:

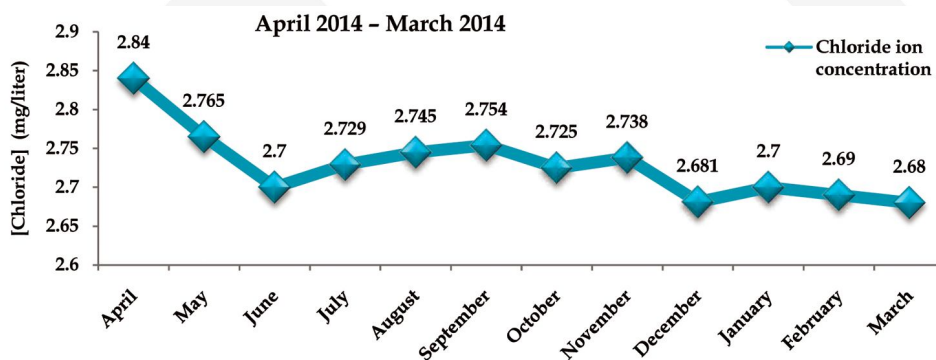


Table 2:

Ion	Average Concentration (mg/liter)
Sulphate, SO ₄ ²⁻	<2.5-6.3
ARSENIC (III)	0.032
FLUORIDE	0.17
LEAD(II)	<0.01
Fe(II)	0.0123
Total Cr	<0.05

Discussion

Phytoplankton and algal growth depends on the variation of nutrients, variation of physico-chemical parameters and the ion concentrations the of river water. High conductance value of river Jalangi indicates the presence of sufficient ions within river water. Sodium (Na⁺), potassium (K⁺), magnesium (Mg²⁺), chloride (Cl⁻), sulphate (SO₄²⁻), phosphate

(PO₄³⁻), carbonate (CO₃²⁻), bicarbonate (HCO₃⁻), nitrate (NO₃⁻) etc. ions are responsible for the salinity of river water. Again, the water salinity acts as an important criteria for the distribution of flora and fauna.

Magnesium, sodium and potassium ion concentrations are maximum during maximum cold and minimum during late manson. The element magnesium is an absolute requirement for all algae, submerge aquatic plants and phytoplaktons as, it is

a constitute for chlorophyll. Magnesium is also essential for the formation of the enzyme catalase. Growth of blue green algae, like nostoc, anabaena show specific nutritional requirement of sodium ion. Sodium ion is also responsible for enzyme activation and water balance within living aquatic systems. The growth and photosynthesis of algae become low, when low potassium ion concentration is present. Potassium ions are also responsible for pH control, osmotic pressure regulations and stability of proteins within the cells of aquatic flora and fauna. Potassium ions maintain the electrochemical environment of the algal cells. Calcium concentration do not vary too much through-out the year. During winter conductance, salinity, total hardness and TDS values reaches maxima. In many algae like *chara sp.*, *cladophora sp.*, calcium remains deposited as calcite on or in the walls or in the mucilage. Calcium ion is responsible for enzyme activation, ion transport and specially skeletal structures of aquatic fauna within river. It should be noted that the breeding season for fisher and residential-birds are monsoon and the processes required enhanced bio-mineralisation rate i.e., formation of calcium carbonate, calcium phosphate etc. from the river water source. Bio-mineralisation is very significant as huge amount of freshwater mussels, fishes, *Pilla sp.*, *Turritella sp.* along with Clam and Oyster are present within river Jalangi. This also must be noted that, large cladocerans such as *Daphnia* require higher specific quantity of calcium ion. High river water flow rate along with enhanced bio-mineralisation rate during monsoon is significant and the conductance, total dissolved solid, salinity, total alkalinity and hardness reaches minimum value.

Bicarbonate and carbonate concentrations are also maximum during winter; minimum during August-September. Aquatic flora, derive the element carbon, from bicarbonate and carbonate ions, apart from carbondioxide and organic compounds. Through-out the year, the change of nitrate concentration is insignificant and lies between 0.44 – 0.48 ml/liter. Some algae utilize nitrate ions as a source of nitrogen. Phosphate concentration is maximum during spring and minimum during autumn. Algal cells etc. need phosphorous for the formation of phospholipids, nucleic acids and various ester phosphates such as NADP, phosphorylated sugars and ATP. Chloride concentration is maximum during summer and minimum during winter. The element chlorine is significant and essential for algae with respect to Photosystem-II.

Iron is the most important trace metal for the phytoplanktons, aquatic mammals. Iron is an essential element for algae as it is a constituent of cytochromes. In the river Jalangi, average ferrous

concentration is 0.0123 mg/liter. Arsenic is a trace element. Sulphur is present in small amount in all aquatic plant and animal cells. Sulphur is present as sulphate ions within river water. Lead and chromium are toxic metals. High fluoride concentration have adverse effect on flora and fauna, however the Jalangi river water contain very low lead, chromium, arsenic and fluoride ions. During winter, Jalangi river contain huge red water blooms of *Azolla pinnata* which can remove chromium, nickel, copper, zinc and lead from effluent. It can also remove lead from solutions containing 1-1000 ppm.

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