Seasonal Changes in Physico-Chemical Characteristics of the Water of Gosthani Estuary in Visakhapatnam District-Andhra Pradesh, India

S. SOBHA RANI
Principal
Department of Chemistry, Government Degree College
Paderu, Visakhapatnam
India

Abstract:
The current study was carried out to find the seasonal changes in physico-chemical parameters in Gosthani estuary, East coast of Andhra Pradesh, India. The various parameters like temperature, pH and the nutrients (Chemical parameters) like carbonate, bicarbonate, nitrite-nitrogen, nitrate-nitrogen, phosphate and total phosphorus were measured over a period of six months i.e. from November-2014 to April-2015 in both surface and bottom water samples. The overall analysis it was noticed that the fluctuations in physico-chemical parameters of water samples, the Gosthani estuary has been facing the problems of industrial wastes, municipal sewage and anthropogenic activities.

Key words: Estuary, pH, temperature, and anthropogenic activities.

INTRODUCTION

Estuaries are highly productive and excellent nursery and feeding grounds for many commercially important fishes and shrimps [1]. Water is the universal solvent required for all the living beings. Without the knowledge of water quality, it is...
difficult of understand the biological phenomenon fully, because the chemistry of water reveals much about the metabolism of the ecosystem and explains the general hydro-biological inter-relationship. The physico-chemical parameters of water and the dependence of all life process of these factors make it desirable to take water as an environment[2].

Estuarine water exhibit seasonal variations in its physic-chemical characteristics and nutrients content depending of physical and biological processes [3-11]. There are very good reports available to describe seasonal variations of the physic-chemical characters in estuaries from Indian coast[6, 11, 12-22].

The nutrient contents in any coastal water determine its potential fertility[23], and therefore, it is important to gather information about their distribution and behavior in different coastal ecosystems require many inorganic substances, nitrogen, phosphorous and silicon are considered to be more important than the others, as they play key role in phytoplankton abundance, growth and metabolism[24, 25].

Hence the present study on to carry out to investigate on seasonal changes in physico-chemical characteristics of the Gosthani estuary.

**MATERIAL AND METHODS**

Monthly water samples were collected in the forenoon from the station (Gosthani estuary) during November 2014 to April 2015. Temperature, pH were measured using standard instruments viz., centigrade thermometer and Elico pH meter (Model, LC-120) respectively. The nutrients (Chemical parameters) carbonate, bicarbonate, nitrite-nitrogen, nitrate-nitrogen, phosphate and total phosphorus were estimated by adopting standard procedures [26].
RESULTS AND DISCUSSION

The result of physico-chemical parameters observed in different months from November 2014 to April 2015 of Gosthani estuary are represented in Table 1 and 2

Table 1. Variations in physico-chemical parameters of Gosthani Estuary in Surface water during November 2014 to April 2015

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Nov-14</th>
<th>Dec-14</th>
<th>Jan-15</th>
<th>Feb-15</th>
<th>Mar-15</th>
<th>Apr-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>26.4±0.34</td>
<td>25.3±0.24</td>
<td>30.7±0.52</td>
<td>31.7±0.35</td>
<td>32.4±0.54</td>
<td>33.9±0.22</td>
</tr>
<tr>
<td>pH</td>
<td>7.3±0.04</td>
<td>7.2±0.03</td>
<td>7.7±0.07</td>
<td>7.8±0.02</td>
<td>8.0±0.05</td>
<td>8.2±0.01</td>
</tr>
<tr>
<td>Carbonate</td>
<td>7.6±0.24</td>
<td>1.2±0.11</td>
<td>5.7±0.17</td>
<td>13.5±0.33</td>
<td>5.2±0.27</td>
<td>11.7±0.19</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>60.7±0.52</td>
<td>84.7±0.39</td>
<td>110.2±0.44</td>
<td>107.4±0.27</td>
<td>127.5±0.15</td>
<td>117.6±0.28</td>
</tr>
<tr>
<td>Nitrite-nitrogen</td>
<td>35.4±0.11</td>
<td>33.7±0.17</td>
<td>14.8±0.55</td>
<td>9.2±0.47</td>
<td>11.9±0.21</td>
<td>35.0±0.13</td>
</tr>
<tr>
<td>Nitrate-Nitrogen</td>
<td>62.4±0.09</td>
<td>201.2±0.25</td>
<td>110.2±0.44</td>
<td>29.4±0.28</td>
<td>19.8±0.09</td>
<td>209.7±0.48</td>
</tr>
<tr>
<td>Phosphate</td>
<td>40.8±0.42</td>
<td>139.8±0.38</td>
<td>63.2±0.21</td>
<td>45.2±0.33</td>
<td>125.2±0.27</td>
<td>217.4±0.14</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>19.8±0.11</td>
<td>50.2±0.27</td>
<td>35.3±0.17</td>
<td>29.7±0.38</td>
<td>87.8±0.24</td>
<td>94.3±0.22</td>
</tr>
</tbody>
</table>

Table 2. Variations in physico-chemical parameters of Gosthani Estuary in bottom water during November 2014 to April 2015

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Nov-14</th>
<th>Dec-14</th>
<th>Jan-15</th>
<th>Feb-15</th>
<th>Mar-15</th>
<th>Apr-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>25.9±0.39</td>
<td>22.9±0.27</td>
<td>28.7±0.11</td>
<td>30.8±0.64</td>
<td>31.7±0.21</td>
<td>32.7±0.19</td>
</tr>
<tr>
<td>pH</td>
<td>7.4±0.06</td>
<td>7.1±0.11</td>
<td>7.6±0.10</td>
<td>7.8±0.04</td>
<td>8.1±0.01</td>
<td>7.9±0.05</td>
</tr>
<tr>
<td>Carbonate</td>
<td>11.2±0.17</td>
<td>1.6±0.21</td>
<td>7.7±0.22</td>
<td>10.1±0.16</td>
<td>5.0±0.14</td>
<td>10.3±0.26</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>47.4±0.33</td>
<td>38.2±0.29</td>
<td>18.9±0.21</td>
<td>15.8±0.37</td>
<td>13.2±0.41</td>
<td>51.2±0.52</td>
</tr>
<tr>
<td>Nitrite-nitrogen</td>
<td>57.3±0.20</td>
<td>257.4±0.52</td>
<td>42.3±0.47</td>
<td>21.7±0.34</td>
<td>24.4±0.31</td>
<td>287.9±0.29</td>
</tr>
<tr>
<td>Nitrate-Nitrogen</td>
<td>147.2±0.07</td>
<td>110.7±0.09</td>
<td>64.7±0.17</td>
<td>43.4±0.21</td>
<td>153.4±0.08</td>
<td>539.2±0.07</td>
</tr>
<tr>
<td>Phosphate</td>
<td>57.4±0.44</td>
<td>50.4±0.41</td>
<td>51.4±0.42</td>
<td>34.2±0.37</td>
<td>82.7±0.24</td>
<td>168.2±0.21</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>60.9±0.18</td>
<td>87.3±0.23</td>
<td>112.4±0.13</td>
<td>107.4±0.41</td>
<td>127.6±0.28</td>
<td>125.4±0.34</td>
</tr>
</tbody>
</table>

Table 3. Two way ANOVA for difference in surface water samples during June 2014 to April 2015

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows</td>
<td>73983.21</td>
<td>6</td>
<td>12330.54</td>
<td>7.350586</td>
<td>0.000152</td>
<td>2.508189</td>
</tr>
<tr>
<td>Columns</td>
<td>18858.87</td>
<td>4</td>
<td>4714.717</td>
<td>2.810578</td>
<td>0.048032</td>
<td>2.776289</td>
</tr>
<tr>
<td>Error</td>
<td>40259.77</td>
<td>24</td>
<td>1677.49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>133101.8</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Two way ANOVA for difference in bottom water samples during June 2014 to April 2015

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>P-value</th>
<th>F crit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rows</td>
<td>132869.1</td>
<td>6</td>
<td>22144.85</td>
<td>3.244163</td>
<td>0.017686</td>
<td>2.508189</td>
</tr>
<tr>
<td>Columns</td>
<td>81703.26</td>
<td>4</td>
<td>20425.82</td>
<td>2.992329</td>
<td>0.03888</td>
<td>2.776289</td>
</tr>
<tr>
<td>Error</td>
<td>163825.4</td>
<td>24</td>
<td>6826.059</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>378397.8</td>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
pH
In the present study pH values did not show significant variation. It ranged from 7.2 to 8.2 in surface waters and 7.1 to 8.1 in bottom waters. Highest and lowest monthly average values for both surface and bottom waters were recorded during 8.2 (April-2015) 7.2 (December-2014), 8.1 (March-2015), 7.1 (December-2014) respectively. Changes of pH within a very narrow limits was due to extensive buffering capacity of the seawater could be another factor for this marginal change [27].

Temperature:
The observed surface and bottom temperature values ranged from 25.30 to 33.90 °C and 22.9 to 32.7 °C. The Highest and lowest monthly average values for both surface and bottom waters were recorded during 33.9 (April-2015) 25.3 (December-2014), 32.7 (April-2015), 22.9 (December-2014) respectively. The present study results are following the trends in temperature values of previous workers [28, 29].

Carbonate and Bicarbonate:
The carbonate and Bicarbonate values ranged from 1.2 to 11.7 mg/L, 60.7 to 127.5 mg/L, 1.6 to 11.2 mg/L, 13.2 to 51.2 mg/L for surface and bottom water respectively. During the present study the lowest and highest monthly average values for carbonate and bicarbonate both surface and bottom waters were recorded during 1.2 mg/L (December-2014), 127.6 mg/L (March-2015). These results are in agreement with earlier worker [30].

Nitrite-Nitrogen:
Nitrite-Nitrogen values varied from 9.2 to 35.4 µg/L in surface water and 21.7 to 287.9 µg/L in bottom water. Nitrite is often released into the water as an extracellular product of the planktonic organisms [31, 32]. Thus, nitrite distribution depicts an irregular picture and wide variations in coastal milieu. In
the present study a relatively high concentration of nitrite-nitrogen during monsoon was due to heavy rainfall and river discharge [33, 34].

**Nitrate-Nitrogen:**
Nitrate-Nitrogen values varied from 19.8 to 209.7 µg/L in surface water and 43.4 to 53.2 µg/L in bottom water. Variations in nitrate and its reduced inorganic compounds are predominantly the results of biologically activated reactions. Quick assimilation by phytoplankton and enhancement by surface runoff results in large scale spatio-temporal variation of nitrate in the coastal milieu [35-37].

In the present study that low nitrate concentration was noticed in February and March probably due to its utilization by biological activity [38]. The high concentration in Nitrate-Nitrogen during monsoon period was possibly due to heavy rainfall and land drainage and the observations of the present study results were in agreement with the previous workers reported elsewhere [39, 40].

**Phosphate**
Phosphate concentration values varied from 45.2 to 217.4µg/L in surface water and 34.2 to 168.2 µg/L in bottom water. Phosphate constitutes the most important inorganic nutrient that can limit the phytoplankton production in tropical coastal marine ecosystems[41]and thereby the overall ecological processes. The high concentration of phosphate observed in the bottom water was probably due to the liberation of this nutrient from bottom sediments [38].

**Phosphorus:**
Total phosphorus concentration values varied from 19.8 to 94.3 µg/L in surface water and 60.9 to 125.4 µg/L in bottom water. It is well known that the nutrient concentration of the bottom water very much depends on the regenerative capacity of the
bottom sediments [42] and there is regular exchange of phosphorus between the mud and overlapping water[43].

Acknowledgements
The author thanks to the Principal and also to the Head, Department of Chemistry, Government Degree College, Paderu, Visakhapatnam for providing laboratory facilities during the course of this work.

REFERENCES


