CONTENTS

Acknowledgement

Preface

List of Table

List of Figures

CHAPTER-1: Introduction

CHAPTER-2: Experimental (Methodology & Observations)

CHAPTER-3: Results & Discussion

SUMMARY

REFERENCES

List of Publications and Presentations

CAPTION OF TABLES
<table>
<thead>
<tr>
<th>Table No.</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Water requirements for selected industries per unit of product</td>
<td>33</td>
</tr>
<tr>
<td>1.1</td>
<td>Drinking water quality standards as recommended by USPH, WHO &amp; ISI</td>
<td>37</td>
</tr>
<tr>
<td>2.1</td>
<td>Monthwise variation of physico-chemical parameters of site $S_1$ in 2010-2011</td>
<td>78</td>
</tr>
<tr>
<td>2.2</td>
<td>Monthwise variation of physico-chemical parameters of site $S_1$ in 2011-2012</td>
<td>79</td>
</tr>
<tr>
<td>2.3</td>
<td>Monthwise variation of physico-chemical parameters of site $S_2$ in 2010-2011</td>
<td>80</td>
</tr>
<tr>
<td>2.4</td>
<td>Monthwise variation of physico-chemical parameters of site $S_2$ in 2011-2012</td>
<td>81</td>
</tr>
<tr>
<td>2.5</td>
<td>Monthwise variation of physico-chemical parameters of site $S_3$ in 2010-2011</td>
<td>82</td>
</tr>
<tr>
<td>2.6</td>
<td>Monthwise variation of physico-chemical parameters of site $S_3$ in 2011-2012</td>
<td>83</td>
</tr>
<tr>
<td>2.7</td>
<td>Monthwise variation of physico-chemical parameters of site $S_4$ in 2010-2011</td>
<td>84</td>
</tr>
<tr>
<td>2.8</td>
<td>Monthwise variation of physico-chemical parameters of site $S_4$ in 2011-2012</td>
<td>85</td>
</tr>
<tr>
<td>2.9</td>
<td>Monthwise variation of physico-chemical parameters of site $S_5$ in 2010-2011</td>
<td>86</td>
</tr>
<tr>
<td>2.10</td>
<td>Monthwise variation of physico-chemical parameters of site $S_5$ in 2011-2012</td>
<td>87</td>
</tr>
<tr>
<td>2.11</td>
<td>Monthwise variation of physico-chemical parameters of site $S_6$ in 2010-2011</td>
<td>88</td>
</tr>
<tr>
<td>2.12</td>
<td>Monthwise variation of physico-chemical parameters of site $S_6$ in 2011-2012</td>
<td>89</td>
</tr>
<tr>
<td>2.13</td>
<td>Monthwise variation of physico-chemical parameters of</td>
<td></td>
</tr>
</tbody>
</table>
2.14 Monthwise variation of physico-chemical parameters of site S7 in 2010-2011

2.15 Monthwise variation of Colour (Hazen) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.16 Monthwise variation of Colour (Hazen) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.17 Monthwise variation of Odour (Ton) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.18 Monthwise variation of Odour (Ton) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.19 Monthwise variation of pH of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.20 Monthwise variation of pH of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.21 Monthwise variation of Temperature (°C) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.22 Monthwise variation of Temperature (°C) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.23 Monthwise variation of Hardness (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.24 Monthwise variation of Hardness (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.25 Monthwise variation of Alkalinity (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.26 Monthwise variation of Alkalinity (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.27 Monthwise variation of TDS (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.28 Monthwise variation of TDS (ppm) of different sites located
on banks of Tamsa at Azamgarh city in 2011-2012

2.29 Monthwise variation of TS (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.30 Monthwise variation of TS (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.31 Monthwise variation of E. coli (MPN/1000 ml) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.32 Monthwise variation of E. coli (MPN/1000 ml) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.33 Monthwise variation of D.O. (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.34 Monthwise variation of D.O. (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.35 Monthwise variation of B.O.D. (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.36 Monthwise variation of B.O.D. (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.37 Monthwise variation of C.O.D. of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.38 Monthwise variation of C.O.D. (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.39 Monthwise variation of Ca²⁺ (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.40 Monthwise variation of Ca²⁺ (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.41 Monthwise variation of K⁺ (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011

2.42 Monthwise variation of K⁺ (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012

2.43 Monthwise variation of Na⁺ (ppm) of different sites located...
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.44</td>
<td>Monthwise variation of Na(^+) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
<tr>
<td>2.45</td>
<td>Monthwise variation of Fe(^{3+}) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011</td>
</tr>
<tr>
<td>2.46</td>
<td>Monthwise variation of Fe(^{3+}) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
<tr>
<td>2.47</td>
<td>Monthwise variation of As (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011</td>
</tr>
<tr>
<td>2.48</td>
<td>Monthwise variation of As (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
<tr>
<td>2.49</td>
<td>Monthwise variation of Cr (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011</td>
</tr>
<tr>
<td>2.50</td>
<td>Monthwise variation of Cr (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
<tr>
<td>2.51</td>
<td>Monthwise variation of Cl(^-) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011</td>
</tr>
<tr>
<td>2.52</td>
<td>Monthwise variation of Cl(^-) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
<tr>
<td>2.53</td>
<td>Monthwise variation of NO(_3^-) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011</td>
</tr>
<tr>
<td>2.54</td>
<td>Monthwise variation of NO(_3^-) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
<tr>
<td>2.55</td>
<td>Monthwise variation of PO(_4^{3-}) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011</td>
</tr>
<tr>
<td>2.56</td>
<td>Monthwise variation of PO(_4^{3-}) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
<tr>
<td>2.57</td>
<td>Monthwise variation of SO(_4^{2-}) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2010-2011</td>
</tr>
<tr>
<td>2.58</td>
<td>Monthwise variation of SO(_4^{2-}) (ppm) of different sites located on banks of Tamsa at Azamgarh city in 2011-2012</td>
</tr>
</tbody>
</table>
on banks of Tamsa at Azamgarh city in 2011-2012

3.0 BIS drinking water standards (IS-105001-91, Revised 2003)

CAPTION OF FIGURES
<table>
<thead>
<tr>
<th>Fig. No.</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>Map Showing location of Tamsa river in Azamgarh</td>
<td>51</td>
</tr>
<tr>
<td>2.1</td>
<td>Map Showing sampling sites on Tamsa river at Azamgarh city</td>
<td>52</td>
</tr>
<tr>
<td>2.2</td>
<td>A sketch of pathway of Tamsa river in Azamgarh city</td>
<td>53</td>
</tr>
<tr>
<td>2.3</td>
<td>Photograph of site $S_1$</td>
<td>56</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Photograph of site $S_1$</td>
<td>56</td>
</tr>
<tr>
<td>2.4</td>
<td>Photograph of site $S_2$</td>
<td>56</td>
</tr>
<tr>
<td>2.5</td>
<td>Photograph of site $S_3$</td>
<td>57</td>
</tr>
<tr>
<td>2.5.1</td>
<td>Photograph of site $S_3$</td>
<td>57</td>
</tr>
<tr>
<td>2.6</td>
<td>Photograph of site $S_4$</td>
<td>57</td>
</tr>
<tr>
<td>2.7</td>
<td>Photograph of site $S_5$</td>
<td>58</td>
</tr>
<tr>
<td>2.8</td>
<td>Photograph of site $S_6$</td>
<td>58</td>
</tr>
<tr>
<td>2.9</td>
<td>Photograph of site $S_7$</td>
<td>58</td>
</tr>
<tr>
<td>3.1</td>
<td>Monthwise variation of physico-chemical parameters (Colour, pH, T.S., B.O.D.) of site $S_1$</td>
<td>150</td>
</tr>
<tr>
<td>3.2</td>
<td>Monthwise variation of physico-chemical parameters (E. coli, D.O., Chloride) of site $S_1$</td>
<td>151</td>
</tr>
<tr>
<td>3.3</td>
<td>Monthwise variation of physico-chemical parameters (Temperature, C.O.D.) of site $S_1$</td>
<td>152</td>
</tr>
<tr>
<td>3.4</td>
<td>Monthwise variation of physico-chemical parameters (Odour, Calcium, Potassium) of site $S_1$</td>
<td>153</td>
</tr>
<tr>
<td>3.5</td>
<td>Monthwise variation of physico-chemical parameters (Iron, Arsenic, Chromium) of site $S_1$</td>
<td>154</td>
</tr>
<tr>
<td>3.6</td>
<td>Monthwise variation of physico-chemical parameters (Sodium, Nitrate, Phosphte) of site $S_1$</td>
<td>155</td>
</tr>
<tr>
<td>3.7</td>
<td>Monthwise variation of physico-chemical parameters (Hardness, Sulphate) of site $S_1$</td>
<td>156</td>
</tr>
<tr>
<td>3.8</td>
<td>Monthwise variation of physico-chemical parameters (Alkalinity, T.D.S) of site $S_1$</td>
<td>157</td>
</tr>
<tr>
<td>3.9</td>
<td>Monthwise variation of physico-chemical parameters</td>
<td></td>
</tr>
</tbody>
</table>
3.10 Monthwise variation of physico-chemical parameters (E. coli, D.O., Chloride) of site S_2 during 2010-2012
3.11 Monthwise variation of physico-chemical parameters (Temperature, C.O.D.) of site S_2 during 2010-2012
3.12 Monthwise variation of physico-chemical parameters (Odour, Calcium, Potassium) of site S_2 during 2010-2012
3.13 Monthwise variation of physico-chemical parameters (Iron, Arsenic, Chromium) of site S_2 during 2010-2012
3.14 Monthwise variation of physico-chemical parameters (Sodium, Nitrate, Phosphate) of site S_2 during 2010-2012
3.15 Monthwise variation of physico-chemical parameters (Hardness, Sulphate) of site S_2 during 2010-2012
3.16 Monthwise variation of physico-chemical parameters (Alkalinity, T.D.S) of site S_2 during 2010-2012
3.17 Monthwise variation of physico-chemical parameters (Colour, pH, T.S., B.O.D.) of site S_3 during 2010-2012
3.18 Monthwise variation of physico-chemical parameters (E. coli, D.O., Chloride) of site S_3 during 2010-2012
3.19 Monthwise variation of physico-chemical parameters (Temperature, C.O.D.) of site S_3 during 2010-2012
3.20 Monthwise variation of physico-chemical parameters (Odour, Calcium, Potassium) of site S_3 during 2010-2012
3.21 Monthwise variation of physico-chemical parameters (Iron, Arsenic, Chromium) of site S_3 during 2010-2012
3.22 Monthwise variation of physico-chemical parameters (Sodium, Nitrate, Phosphate) of site S_3 during 2010-2012
3.23 Monthwise variation of physico-chemical parameters (Hardness, Sulphate) of site S_3 during 2010-2012
3.24 Monthwise variation of physico-chemical parameters
(Alkalinity, T.D.S) of site S3 during 2010-2012

3.25 Monthwise variation of physico-chemical parameters
(Colour, pH, T.S., B.O.D.) of site S4 during 2010-2012

3.26 Monthwise variation of physico-chemical parameters
(E. coli, D.O., Chloride) of site S4 during 2010-2012

3.27 Monthwise variation of physico-chemical parameters
(Temperature, C.O.D.) of site S4 during 2010-2012

3.28 Monthwise variation of physico-chemical parameters
(Odour, Calcium, Potassium) of site S4 during 2010-2012

3.29 Monthwise variation of physico-chemical parameters
(Iron, Arsenic, Chromium) of site S4 during 2010-2012

3.30 Monthwise variation of physico-chemical parameters
(Sodium, Nitrate, Phosphate) of site S4 during 2010-2012

3.31 Monthwise variation of physico-chemical parameters
(Hardness, Sulphate) of site S4 during 2010-2012

3.32 Monthwise variation of physico-chemical parameters
(Alkalinity, T.D.S) of site S4 during 2010-2012

3.33 Monthwise variation of physico-chemical parameters
(Colour, pH, T.S., B.O.D.) of site S5 during 2010-2012

3.34 Monthwise variation of physico-chemical parameters
(E. coli, D.O., Chloride) of site S5 during 2010-2012

3.35 Monthwise variation of physico-chemical parameters
(Temperature, C.O.D.) of site S5 during 2010-2012

3.36 Monthwise variation of physico-chemical parameters
(Odour, Calcium, Potassium) of site S5 during 2010-2012

3.37 Monthwise variation of physico-chemical parameters
(Iron, Arsenic, Chromium) of site S5 during 2010-2012

3.38 Monthwise variation of physico-chemical parameters
(Sodium, Nitrate, Phosphate) of site S5 during 2010-2012

3.39 Monthwise variation of physico-chemical parameters
(Hardness, Sulphate) of site S during 2010-2012

3.40 Monthwise variation of physico-chemical parameters
(Alkalinity, T.D.S) of site S during 2010-2012

3.41 Monthwise variation of physico-chemical parameters
(Colour, pH, T.S., B.O.D.) of site S during 2010-2012

3.42 Monthwise variation of physico-chemical parameters
(E. coli, D.O., Chloride) of site S during 2010-2012

3.43 Monthwise variation of physico-chemical parameters
(Temperature, C.O.D.) of site S during 2010-2012

3.44 Monthwise variation of physico-chemical parameters
(Odour, Calcium, Potassium) of site S during 2010-2012

3.45 Monthwise variation of physico-chemical parameters
(Iron, Arsenic, Chromium) of site S during 2010-2012

3.46 Monthwise variation of physico-chemical parameters
(Sodium, Nitrate, Phosphite) of site S during 2010-2012

3.47 Monthwise variation of physico-chemical parameters
(Hardness, Sulphate) of site S during 2010-2012

3.48 Monthwise variation of physico-chemical parameters
(Alkalinity, T.D.S) of site S during 2010-2012

3.49 Monthwise variation of physico-chemical parameters
(Colour, pH, T.S., B.O.D.) of site S during 2010-2012

3.50 Monthwise variation of physico-chemical parameters
(E. coli, D.O., Chloride) of site S during 2010-2012

3.51 Monthwise variation of physico-chemical parameters
(Temperature, C.O.D.) of site S during 2010-2012

3.52 Monthwise variation of physico-chemical parameters
(Odour, Calcium, Potassium) of site S during 2010-2012

3.53 Monthwise variation of physico-chemical parameters
(Iron, Arsenic, Chromium) of site S during 2010-2012

3.54 Monthwise variation of physico-chemical parameters
3.55 Monthwise variation of physico-chemical parameters (Sodium, Nitrate, Phosphte) of site S7 during 2010-2012

3.56 Monthwise variation of physico-chemical parameters (Hardness, Sulphate) of site S7 during 2010-2012

3.57 Monthwise variation of Colour of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

3.58 Monthwise variation of Colour of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

3.59 Monthwise variation of Odour of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

3.60 Monthwise variation of Odour of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

3.61 Monthwise variation of pH of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

3.62 Monthwise variation of pH of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

3.63 Monthwise variation of Temperature of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

3.64 Monthwise variation of Temperature of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

3.65 Monthwise variation of Hardness of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

3.66 Monthwise variation of Hardness of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

3.67 Monthwise variation of Alkalinity of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

3.68 Monthwise variation of Alkalinity of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

3.69 Monthwise variation of TDS of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011
Monthwise variation of TDS of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of TS of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of TS of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of E. coli of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of E. coli of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of D.O. of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of D.O. of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of B.O.D. of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of B.O.D. of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of C.O.D. of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of C.O.D. of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of Ca$^{2+}$ of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of Ca$^{2+}$ of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of K$^{+}$ of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of K$^{+}$ of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012
Monthwise variation of Na\(^+\) of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of Na\(^+\) of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of Fe\(^{3+}\) of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of Fe\(^{3+}\) of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of As of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of As of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of Cr of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of Cr of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of Cl\(^-\) of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of Cl\(^-\) of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of NO\(_3^-\) of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of NO\(_3^-\) of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of PO\(_4^{3-}\) of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011

Monthwise variation of PO\(_4^{3-}\) of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012

Monthwise variation of SO\(_4^{2-}\) of different sites located on the banks of Tamsa river at Azamgarh city in 2010-2011
3.100 Monthwise variation of $SO_4^{2-}$ of different sites located on the banks of Tamsa river at Azamgarh city in 2011-2012