OBSERVATION

CHAPTER III

3.1 Water analysis

Water samples collected from the selected sites namely Rajghat, Sandhyamath, Irani Khan, Kotiteertha Lake, Rajaram Lake, Panchganga Ghat and Rajaram Bandhara from Kolhapur city before, during and after the Ganesh festival for the years 2006 and 2007. These samples were analyzed in the laboratory and the observed results are documented here.

3.1.1 pH (Table 1, Graph 1, 2)

Rajghat: pH values of water at Rajghat in the year 2006 showed insignificant increase after 1½ days idol immersion as compared to pH before immersion. After 5^{th} and 10^{th} days immersion pH value showed significant increase as compared to values before immersion.

In 2007, significant increase in pH as compared to before immersion pH was observed after 1½ days and 5^{th} days immersion whereas insignificant increase in pH was observed after 10^{th} days of the immersion of Ganesh idols as compared to pH values before immersion.

Sandhyamath: pH values of water at Sandhyamath in the year 2006 showed insignificant increase after 1½ days immersion as compared to pH before immersion. After 5^{th} and 10^{th} day immersion pH value showed significant increase as compared to values before immersion.

In 2007, insignificant increase in pH as compared to before immersion was observed after 1½ days whereas after 5^{th} days and 10^{th} days of the immersion significant increase in pH was noted as compared to pH values before immersion.

Irani Khan: pH values at water at Irani Khan in 2006 showed insignificant increase after 1 ½ days and 5^{th} days of idol immersion as compared to

values before immersion whereas significant increase in pH value was observed after 10th days of immersion.

In year 2007, pH values of water at Irani Khan showed insignificant increase after 1 ½ days and 5th days immersion as compared to values before immersion whereas significant increase in pH value was observed after 10th days of immersion.

Kotiteertha Lake: pH values of water at Kotiteertha Lake in 2006 showed insignificant increase after 1 ½ days and 5th days immersion as compared to pH before immersion whereas significant increase in pH value was observed after 10th days of immersion.

In 2007, insignificant increase in pH as compared to before immersion was observed after 1½ days whereas after 5th days and 10th days of the immersion significant increase in pH was noted as compared to values before immersion.

Rajaram Lake: pH values of water at Rajaram Lake in 2006 showed insignificant increase after 1 ½ days whereas significant increase in pH was observed after 5th and 10th days of immersion as compared to pH before immersion.

In the year 2007, insignificant increase in pH as compared to before was observed after 1½ days and 5th days of immersion whereas after 10th day of the immersion significant increase in pH was noted as compared to pH values before immersion.

Panchganga Ghat: In 2006, insignificant increase in pH as compared to before immersion was observed after 1½ days and 5th days immersion whereas after 10th days of the immersion significant increase in pH was noted as compared to values before immersion.

In the year 2007, insignificant increase in pH as compared to before immersion was observed after 1½ days and 10th days immersion whereas

after 5th days of the immersion significant increase in pH was noted as compared to pH values before immersion.

Rajaram Bandhara: In the year 2006, insignificant increase in pH as compared to before was observed after 1½ days and 5th days immersion whereas after 10th days of the immersion significant increase in pH was noted as compared to pH values before immersion.

In the year 2007, insignificant decrease in pH as compared to before was observed after 1½ days and 10th days immersion whereas after 5th days of the immersion significant increase in pH was noted as compared to pH values before immersion.

3.1.2 Turbidity (Table 5, Graph 3, 4)

Rajghat: Turbidity of water at Rajghat in 2006 showed insignificant decrease in the values after 1 ½ days immersion whereas after 5th and 10th days immersion significant increase was observed in turbidity as compared to turbidity values before immersion.

In the year 2007, turbidity of Rajghat showed insignificant increase in values after 1 ½ days immersion whereas after 5th and 10th days immersion significant increase was observed in turbidity as compared to turbidity values before immersion.

Sandhyamath: Turbidity at Sandhyamath in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th and 10th days immersion significant increase was observed in turbidity as compared to turbidity values before immersion.

In the year 2007, turbidity of water of Sandhyamath showed insignificant increase in values after 1 ½ days immersion whereas after 5th and 10th days immersion significant increase was observed in turbidity as compared to turbidity values before immersion.

Irani Khan: Turbidity of water at Irani Khan in the year 2006 showed insignificant increase in values after 1½ days immersion whereas after 5th days it showed significant decrease in values. After 10th days of immersion significant rise in turbidity was observed as compared to turbidity values before immersion.

In the year 2007, insignificant increase in turbidity was observed after 1 ½ days and 5 days immersion in Irani Khan whereas significant increase in turbidity as compared to values before immersion was noted after 10th days immersion.

Kotiteertha Lake: Turbidity of water at Kotiteertha Lake in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in turbidity was found after 5th and 10th days immersion as compared to turbidity values before immersion.

Turbidity of Kotiteertha Lake in the year 2007 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in turbidity was found after 5th and 10th days immersion as compared to turbidity values before immersion.

Rajaram Lake: Turbidity of water at Rajaram Lake in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in turbidity was found after 5th and 10th days immersion as compared to turbidity values before immersion.

Turbidity of Rajaram Lake in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in turbidity was found after 5th and 10th days immersion as compared to turbidity values before immersion.

Panchganga Ghat: Turbidity at Panchganga Ghat in the year 2006 showed insignificant increase in values after 1 ½ and 5th days immersion

whereas significant increase in turbidity was found after 10th days immersion as compared to turbidity values before immersion.

Turbidity of water at Panchganga Ghat in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in turbidity was found after 5th days immersion as compared to values before immersion. Again after 10th days immersion turbidity was found to be increased insignificantly as compared to turbidity values before immersion.

Rajaram Bandhara: Turbidity of water at Rajaram Bandhara in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in turbidity was observed after 5th and 10th days immersion as compared to values before immersion.

Turbidity at Rajaram Bandhara in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in turbidity was observed after 5th and 10th days immersion as compared to values before immersion.

3.1.3 Dissolved oxygen (DO) (Table 6, Graph 5, 6)

Rajghat: Dissolved oxygen at Rajghat in the year 2006 showed insignificant decrease in values after 1 ½ days whereas significant decrease in DO was observed after 5th and 10th days immersion as compared to values before immersion.

Dissolved oxygen at Rajghat in the year 2007 showed insignificant decrease in values after 1 ½ days and 5th days immersion whereas significant decrease in DO was observed after 10th days immersion as compared to values before immersion.

Sandhyamath: Dissolved oxygen at Sandhyamath in the year 2006 showed insignificant decrease in values after 1 ½ days whereas significant

decrease in DO was observed after 5th and 10th days immersion as compared to values before immersion.

Dissolved oxygen at Sandhyamath in the year 2007 showed insignificant decrease in values after 1 ½ days whereas after 5th day immersion it showed insignificant increase. After 10th days immersion DO at Sandhyamath showed significant decrease in values as compared to values before immersion.

Irani Khan: Dissolved oxygen at Irani Khan in the year 2006 showed no significant alteration in values after 1 ½ day and 5th days immersion; the values were similar as before. After 10th days of immersion significant increase in DO was noted as compared to values before immersion.

In the year 2007, DO of Irani Khan showed insignificant increase in values after 1 ½ days and 5th days immersion whereas after 10th days significant decrease was observed in DO as compared to values before immersion.

Kotiteertha Lake: The dissolved oxygen at Kotiteertha Lake in the year 2006 showed significant decrease in values after 1 ½ days, 5th days and 10th days of immersion as compared to values before immersion.

In the year 2007, DO at Kotiteertha Lake was fond to be increased insignificantly after 1 ½ days whereas significant decrease in DO was observed after 5th days and 10th days immersion as compared to values before immersion.

Rajaram Lake: Dissolved oxygen at Rajaram Lake in the year 2006 showed no change after 1 ½ days as compared to values before immersion whereas significant decrease in DO after 5th days and 10th days of immersion as compared to values before immersion.

In the year 2007, insignificant increase in DO was observed after 1 ½ days immersion whereas insignificant decrease was noted after 5th days

immersion. After 10th days immersion significant decrease in DO values of Rajaram Lake was observed as compared to values before immersion.

Panchganga Ghat: Dissolved oxygen at Panchganga Ghat in the year 2006 showed insignificant increase in values after 1 ½ days immersion. After 5th days immersion significant decrease in DO was observed as compared to values before immersion whereas no significant decrease was observed in DO after 10th days immersion.

In the year 2007, dissolved oxygen at Panchganga Ghat showed significant decrease in values after 1 ½ days and 5th days immersion as compared to values before immersion whereas insignificant increase in DO was observed after 10th days idol immersion as compared to values before immersion.

Rajaram Bandhara: Dissolved oxygen at Rajaram Bandhara in the year 2006 showed insignificant decrease after 1 ½ days immersion as compared to before. After 5th and 10th days immersion significant decrease was observed in DO as compared to values before immersion.

In the year 2007, DO at Rajaram Bandhara showed significant decrease after 1 ½ days whereas insignificant increase was observed in DO after 5th and 10th days of immersion as compared to values before immersion.

3.1.4 Total dissolved solids (Table 7, Graph 7, 8)

Rajghat: Total dissolved solids of water at Rajghat in the 2006 after 1 ½ days showed significant decrease as compared to values before immersion whereas after 5th and 10th days immersion TDS showed significant increase in values as compared to values before immersion.

In the year 2007, TDS at Rajghat after 1 ½ days, 5th days and 10th days immersion showed significant increase in values as compared to values before immersion.

Sandhyamath: In the 2006, TDS at Sandhyamath after 1 ½ days, 5th days and 10th days immersion showed significant increase in values as compared to values before immersion.

The dissolved solids at Sandhyamath in the year 2007 showed significant increase in values after 1 ½ days, 5th days and 10th days immersion of idols as compared to values before immersion.

Irani Khan: TDS at Irani Khan in the year 2006 showed insignificant increase in values after 1 ½ days immersion as compared to before whereas significant increase in TDS was observed after 5th and 10th days immersion as compared to values before immersion.

TDS at Irani Khan in the year 2007 showed insignificant increase in values after 1 ½ days immersion as compared to before whereas significant increase in TDS was observed after 5th and 10th days immersion as compared to values before immersion.

Kotiteertha Lake: TDS at Kotiteertha Lake in the year 2006 showed insignificant increase in values after 1 ½ days immersion as compared to before whereas significant increase in TDS was observed after 5th and 10th days immersion as compared to values before immersion.

TDS at Kotiteertha Lake in the year 2007 showed significant increase in TDS after 1 ½ days, 5th and 10th days immersion as compared to values before immersion.

Rajaram Lake: TDS at Rajaram Lake in the year 2006 showed significant increase in TDS after 1 ½ days, 5th and 10th days immersion as compared to values before immersion.

In the year 2007, TDS at Rajaram Lake showed significant increase values after 1 ½ days immersion whereas insignificant decrease in TDS was observed after 5th days immersion. After 10th days immersion

significant increase in TDS was observed in Rajaram Lake as compared to values before immersion.

Panchganga Ghat: TDS at Panchganga Ghat in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in TDS was observed after 5th and 10th days immersion as compared to values before immersion.

In the year 2007, TDS at Panchganga Ghat showed significant increase in values after 1 ½ days, 5th days and 10th days immersion as compared to values before immersion.

Rajaram Bandhara: Total dissolved solids at Rajaram Bandhara in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in TDS as compared to values before immersion was observed after 5th and 10th days immersion of idols.

In the year 2007, significant increase in total dissolved solids at Rajaram Bandhara was observed after 1 ½ days, 5th days and 10th days immersion of Ganesh idols.

3.1.5 Hardness (Table 8, Graph 9, 10)

Rajghat: Hardness at Rajghat in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Hardness at Rajghat in the year 2007 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Sandhyamath: Hardness at Sandhyamath in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas

significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Hardness at Rajghat in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Irani Khan: Hardness at water of Irani Khan in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Hardness at Irani Khan in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Kotiteertha Lake: Hardness at Kotiteertha Lake in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to before.

Hardness at Kotiteertha Lake in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Rajaram Lake: Hardness at Rajaram Lake in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas insignificant increase in hardness values was observed after 5th days immersion. Significant decrease in hardness was observed after10th days immersion as compared to values before immersion.

Hardness at Rajaram Lake in the year 2007 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Panchganga Ghat: Hardness at Panchganga Ghat in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Hardness at Panchganga Ghat in the year 2007 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

Rajaram Bandhara: Hardness at Rajaram Bandhara in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas significant increase in hardness values was observed after 5th and 10th days immersion as compared to values before immersion.

In the year 2007, hardness at Rajaram Bandhara showed significant increase in values after 1 ½ days, 5th days and 10th days immersion as compared to values before immersion.

3.1.6 Biochemical oxygen demand (Table 9, Graph 11, 12)

Rajghat: BOD at Rajghat in the year 2006 showed insignificant decrease in values as compared to control after 1 ½ days whereas significant increase in BOD was observed after 5th and 10th days immersion as compared to values before immersion.

In the year 2007, no change was observed in BOD values after 1 ½ days immersion whereas significant increase in BOD was noted after 5th and 10th days immersion as compared to values before immersion.

Sandhyamath: Biochemical oxygen demand at Sandhyamath in the year 2006 showed insignificant decrease in values after 1 ½ days whereas significant increase in BOD values was observed after 5th and 10th days.

In the year 2007, BOD values at Sandhyamath showed insignificant increase after 1 ½ days immersion whereas significant increase in BOD was observed after 5th and 10th days immersion as compared to values before immersion.

Irani Khan: Biochemical oxygen demand at Irani Khan in the year 2006 showed insignificant decrease in values after 1 ½ days whereas significant increase in BOD values was observed after 5th and 10th days.

In the year 2007, BOD values at Irani Khan showed insignificant increase after 1 ½ days and 5th days immersion whereas significant increase in BOD was observed after 10th days immersion as compared to values before immersion.

Kotiteertha Lake: Biochemical oxygen demand at Kotiteertha Lake in the year 2006 showed insignificant increase in values after 1 ½ days whereas significant increase in BOD values was observed after 5th and 10th days.

Biochemical oxygen demand at Kotiteertha Lake in the year 2007 showed insignificant decrease in values after 1 ½ days whereas significant increase in BOD values was observed after 5th and 10th days as compared to values before immersion.

Rajaram Lake: Biochemical oxygen demand at Rajaram Lake in the year 2006 showed insignificant decrease in values after 1 ½ days whereas significant increase in BOD values was observed after 5th and 10th days as compared to values before immersion.

Biochemical oxygen demand at Rajaram Lake in the year 2007 showed insignificant increase in values after 1 ½ days whereas significant

increase in BOD values was observed after 5th and 10th days as compared to values before immersion.

Panchganga Ghat: Biochemical oxygen demand at Panchganga Ghat in the year 2006 showed insignificant decrease in values after 1 ½ days and 5th days immersion as compared to before whereas significant increase in BOD values was observed after 10th days as compared to values before immersion.

Biochemical oxygen demand at Panchganga Ghat in the year 2007 showed insignificant increase in values after 1 ½ days whereas significant increase in BOD values was observed after 5th and 10th days as compared to values before immersion.

Rajaram Bandhara: Biochemical oxygen demand at Rajaram Bandhara in the year 2006 showed insignificant decrease in values after 1 ½ days whereas significant decrease after 5th days immersion as compared to before Significant increase in BOD values was observed after 10th days as compared to values before immersion.

Biochemical oxygen demand at Panchganga Ghat in the 2007 showed insignificant increase in values after 1 ½ days whereas significant increase in BOD values was observed after 5th and 10th days as compared to values before immersion.

3.1.7 Chemical oxygen demand (Table 10, Graph 13, 14)

Rajghat: Chemical oxygen demand at Rajghat in the year 2006 showed no change after 1 ½ days immersion whereas significant increase in COD was observed after 5th and 10th days immersion as compared to values before immersion.

In the year 2007, COD at Rajghat showed insignificant decrease in values after 1 ½ days immersion whereas significant increase was

observed after 5th and 10th days immersion as compared to values before immersion.

Sandhyamath: In the year 2006, COD at Sandhyamath showed insignificant increase in values after 1 ½ days immersion whereas significant increase was observed after 5th and 10th days immersion as compared to values before immersion.

COD at Sandhyamath in the year 2007 showed insignificant increase in values after 1 ½ days immersion whereas significant increase was observed after 5th and 10th days immersion as compared to values before immersion.

Irani Khan: In the year 2006, COD of Rajghat showed insignificant decrease in values after 1 ½ days immersion whereas significant decrease was observed after 5th days immersion as compared to before. After 10th days immersion significant increase in COD values was observed as compared to values before immersion.

In the year 2007, COD at Irani Khan showed insignificant increase in values after 1 ½ day immersion whereas significant increase was observed after 5th and 10th days immersion as compared to values before immersion.

Kotiteertha Lake: COD values at Kotiteertha Lake in the year 2006 showed significant increase in values after 1 ½ days, 5th days and 10th days immersion as compared to values before immersion.

In the year 2007, COD at Kotiteertha Lake showed insignificant decrease in values after 1 ½ days immersion whereas significant increase was observed after 5th and 10th days immersion as compared to values before immersion.

Rajaram Lake: COD at Rajaram Lake in the year 2006 showed no significant change in values after 1 ½ days and 5th days immersion of idols whereas significant increase in values was observed after 10th days immersion of idols as compared to values before immersion.

In the year 2007, COD at Rajaram Lake showed insignificant decrease in values after 1 ½ days immersion as compared to before whereas significant increase in COD was observed after 5th and 10th days immersion as compared to values before immersion.

Panchganga Ghat: The COD at Rajghat in the year 2006 showed insignificant alterations in values after 1 ½ days, 5th days and 10th days immersion as compared to values before immersion.

In the year 2007, COD at Panchganga Ghat showed insignificant increase in values after 1 ½ days immersion as compared to before whereas significant decrease in COD was observed after 5th days immersion. After 10th days immersion no change was observed as compared to values before immersion.

Rajaram Bandhara: COD values at Rajaram Bandhara in the year 2006 after 1 ½ days, 5th days and 10th days showed insignificant alterations in values. All values are within normal range.

In the year 2007, COD at Rajaram Bandhara showed no change in values after 1 ½ days and 10th days immersion whereas significant decrease in values after 5th days immersion as compared to values before immersion.

3.1.8 Nitrates (Table 11, Graph 15, 16)

Rajghat: Nitrates at Rajghat in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th and 10th days nitrates showed significant increase in values as compared to values before immersion.

Nitrates at Rajghat in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th and 10th days nitrates showed significant increase in values as compared to values before immersion.

Sandhyamath: Nitrates at Sandhyamath in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th and 10th days nitrates showed significant increase in values as compared to values before immersion.

Nitrates at Sandhyamath in the year 2007 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th and 10th days nitrates showed significant increase in values as compared to values before immersion.

Irani Khan: Nitrates at Irani Khan in the year 2006 showed insignificant increase in values after 1 ½ days immersion whereas after 5th and 10th days nitrates showed significant increase in values as compared to values before immersion.

Nitrates at Irani Khan in the 2007 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th and 10th days nitrates showed significant increase in values as compared to values before immersion.

Kotiteertha Lake: Nitrates at Kotiteertha Lake in the year 2006 showed insignificant increase in values after 1 ½ days and 5th days immersion whereas after 10th days nitrates showed significant increase in values as compared to values before immersion.

Nitrates at Kotiteertha Lake in the year 2007 showed insignificant increase in values after 1 ½ days immersion whereas after 5th and 10th days immersion nitrates showed significant increase in values as compared to values before immersion.

Rajaram Lake: Nitrates at Rajaram Lake in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th and 10th days immersion nitrates showed significant increase in values as compared to values before immersion.

Nitrates at Rajaram Lake in the 2007 showed insignificant decrease in values after 1 ½ days immersion whereas after 5th days immersion nitrates showed significant decrease in values as compared to before. After 10th days immersion significant increase in values was observed as compared to values before immersion.

Panchganga Ghat: Nitrates at Panchganga Ghat in the year 2006 showed insignificant increase in values after 1 ½ days, 5th days and 10th days immersion of idols as compared to values before immersion.

In the year 2007, insignificant increase in nitrates was observed after 1 ½ days and 5th days immersion whereas after 10th days immersion significant increase in nitrates was observed as compared to values before immersion.

Rajaram Bandhara: Nitrates at Rajaram Bandhara in the year 2006, showed insignificant decrease in values after 1 ½ days immersion whereas after 5th days and 10th days significant increase was observed in nitrates as compared to values before immersion.

In the year 2007, nitrates at Rajaram Bandhara showed insignificant decrease in values after 1 ½ days immersion whereas significant increase was observed after 5th and 10th days immersion as compared to values before immersion.

3.1.9 Phosphates (Table 12, Graph 17, 18)

Rajghat: Phosphates at Rajghat in the year 2006 showed insignificant increase in values after 1 ½ days immersion as compared to values before

immersion whereas significant increase in phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

In the year 2007, phosphates at Rajghat showed insignificant increase in values after 1 ½ days immersion as compared to values before immersion whereas significant increase in phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

Sandhyamath: Phosphates at Sandhyamath in the year 2006 showed insignificant increase in values after 1 ½ days immersion as compared to values before immersion whereas significant increase in phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

Phosphates at Sandhyamath in the year 2007 showed insignificant increase in values after 1 ½ days immersion as compared to values before immersion whereas significant increase in phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

Irani Khan: Phosphates at Irani Khan in the year 2006 showed no significant alteration in values after 1 ½ days and 5th days immersion as compared to values before immersion whereas significant increase in phosphates was observed after 10th days immersion as compared to values before immersion.

In 2007, Phosphates at Irani Khan showed insignificant increase in values after 1 ½ days immersion as compared to values before immersion whereas significant increase in phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

Kotiteertha Lake: Phosphates at Kotiteertha Lake in the year 2006 showed insignificant increase in values after 1 ½ days immersion as compared to values before immersion whereas significant increase in

phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

In the year 2007, Phosphates at Kotiteertha Lake showed insignificant increase in values after 1 ½ days immersion as compared to values before immersion whereas significant increase in phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

Rajaram Lake: Phosphates at Rajaram Lake in the year 2006 showed insignificant decrease in values after 1 ½ days immersion whereas significant increase in phosphates was observed after 5th and 10th days immersion s compared to values before immersion.

In the year 2007, phosphates at Rajaram Lake showed insignificant decrease after 1 ½ days immersion whereas after 5th days insignificant increase was found in phosphates. After 10th days immersion significant increase in phosphates was observed as compare to values before immersion.

Panchganga Ghat: Phosphates at Panchganga Ghat in the year 2006 showed significant decrease in values after 1 ½ days, 5th days and 10th days immersion of idols as compared to values before immersion.

In the year 2007, insignificant change in phosphates at Panchganga Ghat was observed after 1 ½ days, 5th days and 10th days immersion as compared to values before immersion. All values were found within range.

Rajaram Bandhara: Phosphates at Rajaram Bandhara in the 2006 showed insignificant increase in values as compared to values before immersion whereas significant decrease in phosphates was observed after 5th and 10th days immersion as compared to values before immersion.

In the year 2007, insignificant alterations in the phosphates at Rajaram Bandhara were found after 1 ½ days, 5th days and 10th days immersion as compared to values before immersion.

3.1.10 Calcium (Table 13, Graph 19)

Calcium content at Rajghat, Sandhyamath, Irani Khan, Kotiteertha Lake, Panchganga Ghat and Rajaram Bandhara was found to be increased significantly after the immersion of the idols as compared to values before immersion whereas Rajaram Lake showed insignificant increase in values of calcium after the idol immersion.

3.1.11 Magnesium (Table 13, Graph 20)

Significant increase was observed in Magnesium values of Rajghat, Sandhyamath, Irani Khan, Kotiteertha lake, Rajaram lake and Panchganga Ghat after the immersion of idols as compared to values before immersion. Rajaram Bandhara showed insignificant increase in Magnesium content after idol immersion.

3.1.12 Heavy metals (Table 14, 15)

Copper: Copper content at the sites Rajghat, Sandhyamath, Irani Khan, Kotiteertha Lake, Rajaram Lake, Panchganga Ghat and Rajaram Bandhara increased significantly after immersion of idols as compared to values before immersion.

Lead: Lead content at the sites Rajghat, Sandhyamath, Irani Khan, Kotiteertha Lake, Rajaram Lake, Panchganga Ghat and Rajaram Bandhara increased significantly after immersion of idols as compared to values before immersion.

Zinc: Zinc content at the sites Rajghat, Sandhyamath, Irani Khan, Kotiteertha Lake, Rajaram Lake and Rajaram Bandhara increased

significantly after immersion of idols as compared to before whereas Panchganga Ghat showed insignificant increase in zinc levels after idol immersion as compared to values before immersion.

Chromium: Rajghat, Sandhyamath, Irani Khan and Kotiteertha Lake showed significant increase in chromium levels after the immersion of idols as compared to values before immersion whereas chromium values of Rajaram Lake, Panchganga Ghat and Rajaram Bandhara were found below detectable limits before and after immersion of idols.

3.2 Acclimatization of animals

Animals collected from the field were transported to the laboratory and transferred to glass aquaria. Ten bivalves were kept in each aquarium with 5 liters of pond water. The closed shell valves started to open with extending pallial edges as well as siphons out of the valves. Sometimes extension of foot to maximum extent was found. Gentle mechanical stimulus made the extended organs to retract in shell valves immediately. These animals were acclimatized to the laboratory conditions for 15 days prior to the experiment.

3.3 Toxicity symptoms

The shells of the bivalves most of the times remained closed. Sometimes they slightly opened the shell valves and protruded the foot slightly along with the pallial edges and siphons outside the shells. Gentle mechanical stimulus made these bivalves to retract the foot slowly but not completely and they partially closed the shell valves. The died animal showed widely opened shell valves with foot shrunken or swollen. Gentle mechanical stimulus had no effect on the animal. This condition was recorded for the mortality of the bivalves. The dead animals were removed from the tanks and their number was recorded.

3.4 Percentage mortality of the freshwater bivalve, *Lamellidens marginalis* exposed to toxicity of colour pigments for different time intervals.

Sr. No.	Concentration ppm	24 hrs	48 hrs	72 hrs	96hrs	Total mortality (%)
1	1000	-	-	-	-	-
2	2000	-	-	-	-	-
3	3000	-	-	-	-	-
4	4000	-	-	-	-	-
5	5000	-	-	-	-	10
6	6000	-	-	10%	10%	20
7	7000	-	-	10%	20%	30
8	8000	-	10%	10%	20%	40
9	8500	-	10%	20%	10%	40
10	9000	10%	10%	10%	20%	50

For each test 10 animals were used.

LC_0 = 4000 ppm is the concentration for 0% mortality.

LC_{50} = 9000 ppm is the concentration for 50% moratlity.

LC_0 sublethal concentration i. e. 400 ppm

LC_{50} sublethal concentration i.e. 900 ppm

3.5 Toxicity of PoP and clay idols

3.5.1 Immersion of idols

The Plaster of Paris and Shadoo clay Ganesh idols were immersed in water in the glass aquaria. The PoP idol remained intact in water for several days. After few weeks, the chips of paints got separated from the PoP surface and settled in the bottom of tank. The thinner sections like fingers, teeth, ears and ornaments became brittle and could get broken after application of gentle force.

In contrast, idol made up of 'Shadoo' clay when placed in water tank started absorbing water quickly and clay started becoming wet. The wet portions fell from idol surface. Thus disintegration of clay idol was far faster than PoP idol. Within two hours time the whole idol formed clay at the bottom of the aquarium.

3.5.2 Water analysis

Sr. No.	Parameter	Before idol immersion	After POP idol immersion	After clay idol immersion
1	pH	7.4	7.8	7.2
2	Turbidity(NTU)	1.7	1.3	2.4
3	TDS	80	110	90
4	DO	5.34	4.88	5.24
5	Hardness	18	24	16
6	BOD	0.38	0.36	0.42
7	COD	24	32	28
8	Nitrate	0.3	0.26	0.30
9	Phosphate	0.16	0.18	0.14

*All values are in mg/l except pH and turbidity

3.6 Accumulation Study (Table 16)

The bivalves, *Lamellidens marginalis* were exposed to the 400 ppm and 900 ppm concentrations of colour pigments for 10 days and 20 days. After completion of the exposure period whole bodies of these animals were analyzed for the heavy metals like copper, zinc, lead and chromium for accumulation study. Whole soft body of the animal was used for detection of heavy metals. These elements were detected by Atomic Absorption Spectrophotometry and results are documented here.

3.6.1 Copper: After exposure to the colour pigments at 400 ppm and 900 ppm for 10 days and 20 days the body of the bivalve, *Lamellidens marginalis* showed significant increase in accumulation of copper as compared to control. With increase in dose concentration and exposure period increase in accumulation was observed.

3.6.2 Zinc: Significant increase was observed in the accumulated zinc in the body of the bivalve after exposure to the colour pigments at 400 ppm and 900 ppm for 10 days and 20 days as compared to control.

3.6.3 Chromium: As the concentration of the colour pigments and the exposure period levels of chromium were found to be increased significantly in the body of the bivalve, *Lamellidens marginalis* as compared to control.

3.6.4 Lead: As compared to control the lead accumulation in the body of the bivalve was found to be increased significantly in 400 ppm as well as in 900 ppm colour pigments for 10 days and 20 days of exposure periods.

3.7 Biochemical studies:

The biochemicals namely total proteins, glycogen, cholesterol and lactic acid were analyzed from the bivalve, *Lamellidens marginalis* exposed to different concentrations of the colour pigments for 10 days and 20 days and compared them with controls. The results of the biochemicals estimated from different tissues of the bivalves exposed to clay and PoP

idol immersed water are reported here. They are also compared with control.

3.7.1 Protein (Table 17, 18 and Graph 21,22)

Muscles: The protein content in the muscles of *Lamellidens marginalis* exposed to 400 ppm colour pigments after 10 days showed insignificant change whereas in the same concentration after 20 days it decreased significantly from control. In 900 ppm colour pigment concentration after 10 days and 20 days significant decrease was found in proteins.

In PoP idol total proteins showed significant decrease in muscle whereas in clay idol insignificant decrease was observed in proteins as compared to control.

Mantle: The protein content in the mantle of *Lamellidens marginalis*, exposed to 400 ppm and 900 ppm colour pigments after 10 days and 20 days showed significant decrease as compared to control.

The protein content in the mantle of the bivalve exposed to the PoP and clay idol for 15 days decreased significantly as compared to control.

Gills: The protein content in the gills of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments for 10 days and 20 days showed significant decrease as compared to control.

The protein content in the gills of the bivalves exposed to clay idol and PoP idol decreased significantly as compared to control.

Foot: The protein content in the foot of *Lamellidens marginalis* exposed 400 ppm and 900 ppm colour pigments for 10 days and 20 days decreased significantly.

In clay and PoP idol water the protein content in foot was found to be decreased as compared to control.

Hepatopancreas: The protein content in hepatopancreas of *Lamellidens marginalis* in 400 ppm colour pigments after 10 days showed insignificant decrease whereas in the same concentration after 20 days it decreased significantly as compared to control. In 900 ppm exposure after 10 days and 20 days significant decrease was found in proteins.

The protein content in hepatopancreas decreased significantly as compared to control after exposure to both clay and PoP idols for 15 days.

Gonads: The protein content in gonads of the freshwater bivalve, *Lamellidens marginalis* exposed to 400 ppm and in 900 ppm colour pigments for 10 days and 20 days decreased significantly as compared to control.

In PoP idol water proteins were found to be decreased significantly in gonads whereas in clay idol insignificant decrease was reported in proteins as compared to control.

3.7.2 Glycogen (Table 19,20 and Graph 23,24)

Muscles: The glycogen content in the muscles of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments after 10 days and 20 days showed significant decrease as compared to control.

The glycogen content in the muscle of the bivalves exposed to PoP idol for 15 days showed insignificant decrease as compared to control whereas glycogen in muscles of the bivalves in clay idol showed significant decrease as compared to control.

Mantle: The glycogen content in mantle of *Lamellidens marginalis* in 400 ppm colour pigments after 10 days showed insignificant decrease whereas in the same concentration after 20 days it decreased significantly as compared to control. In 900 ppm after 10 days and 20 days significant decrease was found in glycogen as compared to control.

Significant decrease in glycogen content in mantle as compared to control was observed in bivalves exposed to clay as well as PoP idol for 15 days.

Gills: The glycogen content in the gills of the bivalve of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments after 10 days no significant decrease was found in glycogen of gills whereas after 20 days in both concentrations significant decrease in glycogen content was observed as compared to control.

After exposure to the clay idol as well as PoP idol for 15 days the glycogen content was decreased significantly in gills of the bivalve.

Foot: The glycogen content in the foot of *Lamellidens marginalis*, for 400 ppm colour pigments after 10 days and 20 days exposure showed insignificant decrease compared to control. In 900 ppm after 20 days glycogen content showed significant decrease whereas after 10 days exposure insignificant decrease was observed in glycogen content as compared to control.

The glycogen content in the foot of the bivalves exposed to clay as well as PoP idol after 15 days showed insignificant decrease as compared to control.

Hepatopancreas: the glycogen content in the hepatopancreas of *Lamellidens marginalis*, for 400 ppm colour pigments after 10 days and 20 days showed insignificant decrease as compared to control. In 900 ppm after 20 days glycogen content showed significant decrease whereas after 10 days exposure no significant decrease was observed as compared to control.

After exposure to the clay idol as well as PoP idol for 15 days the glycogen content was decreased significantly as compared to control in hepatopancreas of the bivalves.

Gonads: The glycogen content in the gonads of *Lamellidens marginalis*, exposed to 400 ppm and 900 ppm colour pigments showed significant decrease in glycogen as compared to control.

The glycogen content in the gonads of the bivalves exposed to PoP and clay idol for 15 days showed significant decrease as compared to control.

3.7.3 Cholesterol (Table 21,22 and Graph 25,26)

Muscles: The cholesterol content in muscles of *Lamellidens marginalis* in 400 ppm colour pigments after 10 days showed insignificant decrease whereas in the same concentration after 20 days it decreased significantly as compared to control. In 900 ppm after 10 days and 20 days significant decrease was found in cholesterol as compared to control.

Significant decrease in cholesterol content in muscle as compared to control was observed in bivalves exposed to clay as well as PoP idol.

Mantle: The cholesterol content in the mantle of *Lamellidens marginalis*, exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed significant decrease in cholesterol as compared to control.

The cholesterol content in the mantle of the bivalves exposed to PoP and clay idol for 15 days showed significant decrease as compared to control.

Gills: The cholesterol content in the gills of *Lamellidens marginalis* exposed to 400 ppm after 10 days and 20 days showed insignificant decrease as compared to control. In 900 ppm after 10 days and 20 days significant decrease was observed in cholesterol content in the gills as compared to control.

Significant decrease in cholesterol content as compared to control was reported in gills of the bivalves exposed to the clay and PoP idols for 15 days.

Foot: The cholesterol content in the foot of *Lamellidens marginalis* exposed to 400 ppm colour pigments after both the exposure periods showed insignificant decrease as compared to control. In 900 ppm after 20 days it showed significant decrease whereas after 10 days exposure no significant change was observed in cholesterol content as compared to control.

After exposure to PoP and clay idols for 15 days cholesterol content in the foot of the bivalve showed insignificant decrease as compared to control.

Hepatopancreas: The cholesterol content in the hepatopancreas of *Lamellidens marginalis* exposed to 400 ppm after 10 days and 20 days showed insignificant decrease as compared to control. In 900 ppm after 10 days and 20 days significant decrease was observed in cholesterol content in the hepatopancreas as compared to control.

In hepatopancreas of the bivalves, after exposure to the PoP idol the cholesterol content was decreased significantly as compared to control whereas in clay idol it decreased insignificantly after 15 days exposure.

Gonads: The cholesterol content in the gonads of *Lamellidens marginalis* exposed to 400 ppm colour pigments after both the exposure periods showed insignificant decrease as compared to control. In 900 ppm after 20 days it showed significant decrease whereas after 10 days exposure no significant change was observed in cholesterol content as compared to control.

Significant decrease was observed in cholesterol content of gonads as compared to control bivalves exposed to both clay as well as PoP idols for 15 days.

3.7.4 Lactic acid (Table 23,24, and Graph 27,28)

Muscles: The lactic acid content in muscle of *Lamellidens marginalis* in 400 ppm of colour pigments after 10 days showed insignificant increase but in the same concentration after 20 days it increased significantly. In 900 ppm after 10 days as well as 20 days exposure significant increase was found in lactic acid as compared to control.

The lactic acid content in the muscles of *Lamellidens marginalis* exposed to PoP and clay idols for 15 days showed significant increase as compared to control.

Mantle: The lactic acid content in the mantle of *Lamellidens marginalis*, exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed significant increase as compared to control.

Insignificant change in lactic acid content was observed in mantle of bivalves exposed to both clay as well as PoP idol for 15 days as compared to control.

Gills: The lactic acid content in gills of *Lamellidens marginalis* exposed to 400 ppm colour pigments after both the exposure periods showed insignificant increase as compared to control. In 900 ppm exposure for 20 days it showed significant increase whereas after 10 days exposure no significant increase was observed in lactic acid content as compared to control.

In clay and PoP idols after 15 days exposure significant increase in lactic acid content as compared to control was reported in gills of the bivalves.

Foot: The lactic acid content in the foot of *Lamellidens marginalis*, exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed significant increase as compared to control.

Insignificant decrease was observed in lactic acid content as compared to control foot of bivalves exposed to both clay as well as PoP idol for 15 days.

Hepatopancreas: The lactic acid content in the hepatopancreas of *Lamellidens marginalis*, exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed significant increase as compared to control.

Significant increase in lactic acid content as compared to control was reported in hepatopancreas of the bivalves in clay and PoP idols after 15 days exposure.

Gonads: The lactic acid content in gonads of *Lamellidens marginalis* exposed to 400 ppm colour pigments after both the exposure periods showed insignificant increase as compared to control. In 900 ppm after 20 days it showed significant increase whereas after 10 days exposure no significant increase was observed in lactic acid content as compared to control.

The lactic acid content in the gonads of the bivalves exposed to the PoP and clay idol for 15 days showed insignificant decrease as compared to the control.

3.8 Enzymes studies

3.8.1 Acid phosphatase (Table 25, 26 and Graph 29,30)

Muscles: The acid phosphatase activity in the muscles of *Lamellidens marginalis*, exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed significant increase as compared to control.

After 15 days exposure of the bivalves to the clay idol, muscles showed insignificant rise in acid phosphatase activity while significant increase in enzyme activity was found in PoP idol exposed bivalves as compared to control.

Mantle: The acid phosphatase activity in mantle of *Lamellidens marginalis* in 400 ppm colour pigments after 10 days showed insignificant increase but in the same concentration after 20 days it increased significantly. In 900 ppm after 10 days as well as 20 days significant increase was found in ACP activity.

The mantle also showed insignificant increase in ACP activity after exposure to clay idol whereas in PoP idol exposed bivalves mantle showed significantly increased ACP activity as compared to control.

Gills: The acid phosphatase activity in gills of *Lamellidens marginalis* in 400 ppm after 10 days exposure showed insignificant increase but in the same concentration after 20 days it increased significantly. In 900 ppm after 10 days as well as 20 days significant increase was found in ACP activity.

Insignificant increase was observed in acid phosphatase activity of gills of bivalves exposed to both clay as well as PoP idol for 15 days as compared to control.

Foot: The acid phosphatase activity in foot of *Lamellidens marginalis* in 400 ppm after 10 days showed insignificant increase but in the same

concentration after 20 days it increased significantly. In 900 ppm after 10 days as well as 20 days exposure significant increase was found in ACP activity.

Insignificant increase was observed in acid phosphatase activity of foot of bivalves exposed to both clay as well as PoP idol for 15 days as compared to control.

Hepatopancreas: The acid phosphatase activity in hepatopancreas of *Lamellidens marginalis* in 400 ppm after 10 days showed insignificant increase but in the same concentration after 20 days it increased significantly. In 900 ppm after 10 days as well as 20 days significant increase was found in ACP activity.

After exposed to clay as well as PoP idol for 15 days ACP activity in hepatopancreas was found to be increased insignificantly as compared to control.

Gonads: In gonads of *Lamellidens marginalis*, significant increase in acid phosphatase activity was observed in 400 ppm and 900 ppm concentrations of the colour pigments for both the exposure periods.

Significant increase in acid phosphatase activity as compared to control was observed in gonads of the bivalves exposed to clay as well PoP idols for 15 days.

3.8.2 Alkaline phosphatase (Table 27,28 and Graph 31,32)

Muscles: The ALP activity in muscles of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm of the colour pigments after 10 days and 20 days showed significant increase as compared to control.

Muscles showed significant increase in ALP activity after exposure to PoP idol while in clay idol exposed bivalve muscles showed insignificant increase in ALP activity as compared to control.

Mantle: The ALP activity in mantle of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm of the colour pigments after 10 days and 20 days showed significant increase as compared to control.

Significant increase in alkaline phosphatase activity was observed in mantle of the bivalves exposed to clay as well PoP idols for 15 days as compared to control.

Gills: The ALP activity in the gills of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm of the colour pigments after 10 days and 20 days showed significant increase as compared to control.

After exposed to clay as well as PoP idol for 15 days ALP activity in gills was found to be increased insignificantly as compared to control.

Foot: The ALP activity in the foot of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm of the colour pigments after 10 days and 20 days showed significant increase as compared to control.

When exposed to PoP idol for 15 days ALP activity was increased insignificantly in foot of the bivalves whereas in clay idol slight change was observed which is insignificant as compared to control.

Hepatopancreas: The ALP activity in the hepatopancreas of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm of the colour pigments after 10 days and 20 days showed significant increase as compared to control.

Hepatopancreas showed significant increase in ALP activity after exposure to PoP idol as compared to control while in clay idol exposed bivalves, insignificant increase in ALP activity was observed.

Gonads: The ALP activity in the gonads of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm of the colour pigments after 10 days and 20 days showed significant increase as compared to control.

Significant increase in alkaline phosphatase activity was observed in gonads of the bivalves exposed to clay as well PoP idols for 15 days as compared to control.

3.8.3 Glutamate Oxaloacetic Transaminase (Table 29,30 and Graph 33,34)

Muscles: The GOT activity in muscles of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

Muscles showed significant increase in GOT activity after exposure to PoP idol whereas in clay idol exposed bivalves, insignificant increase in GOT activity was observed as compared to control.

Mantle: The GOT activity in mantle of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

Mantle showed significant increase in GOT activity after exposure to PoP idol whereas in clay idol exposed bivalves, insignificant increase in GOT activity was observed as compared to control.

Gills: The GOT activity in the gills of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

After exposed to clay as well as PoP idol for 15 days insignificant change was observed in GOT activity in gills as compared to control.

Foot: The GOT activity in the foot of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

When exposed to PoP idol and clay idol for 15 days GOT activity was changed insignificantly in foot of the bivalves as compared to control.

Hepatopancreas: The GOT activity in the foot of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

Hepatopancreas showed significant increase in GOT activity as compared to control after exposure to PoP idol whereas in clay idol exposed bivalves, insignificant increase in GOT activity was observed.

Gonads: The GOT activity in gonads of *Lamellidens marginalis* exposed to 400 ppm colour pigments after both the exposure periods showed insignificant increase as compared to control. In 900 ppm after 20 days exposure it showed significant increase whereas after 10 days exposure no significant increase was observed in GOT activity as compared to control.

Gonads also showed significant increase in GOT activity after exposure to PoP idol whereas in clay idol exposed bivalves, insignificant increase in GOT activity was observed after 15 days as compared to control.

3.8.4 Glutamate Pyruvic Transaminase (Table 31,32 and Graph 35,36)

Muscles: The GPT activity in muscles of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days exposure showed insignificant increase as compared to control.

After exposed to clay as well as PoP idol for 15 days insignificant change was observed in GPT activity in muscles of the bivalves as compared to control.

Mantle: The GPT activity in mantle of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

After 15 days exposure to PoP idol insignificant increase was observed in GPT activity whereas in clay idol slight insignificant decrease was found in enzyme activity as compared to control.

Gills: The GPT activity in gills of *Lamellidens marginalis* exposed to 400 ppm colour pigments after both the exposure periods showed insignificant increase as compared to control. In 900 ppm after 20 days it showed significant increase whereas after 10 days exposure no significant increase was observed in GPT activity as compared to control.

Gills showed significant increase in GPT activity after exposure to PoP idol whereas in clay idol exposed bivalves, insignificant increase in GPT activity was observed after 15 days as compared to control.

Foot: The GPT activity in foot of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

When exposed to PoP idol for 15 days GPT activity was increased insignificantly in foot of the bivalves. No change was observed in foot of bivalves exposed to clay idol as compared to control.

Hepatopancreas: : The GPT activity in the hepatopancreas of *Lamellidens marginalis* exposed to 400 ppm and 900 ppm colour pigments for 10 days and 20 days showed insignificant increase as compared to control.

Hepatopancreas showed significant increase in GPT activity after exposure to PoP idol whereas in clay idol exposed bivalves, slight insignificant increase in GPT activity was observed after 15 days as compared to control.

Gonads: The GPT activity in the gonads of *Lamellidens marginalis* exposed to 400 ppm after 10 days and 20 days showed insignificant

increase as compared to control. In 900 ppm after 10 days and 20 days significant increase was observed in GPT activity in the gonads as compared to control.

GPT activity was found to be increased significantly in gonads of the bivalves exposed to PoP as well as clay idols for 15 days as compared to control.

3.8.5 Adenosine Triphosphatase (Table 33,34 and Graph 37,38)

Muscles: The ATPase activity in the muscles of *Lamellidens marginalis* exposed to 400 ppm after 10 days and 20 days showed insignificant decrease as compared to control. In 900 ppm after 10 days and 20 days significant decrease was observed in ATPase activity in the muscles as compared to control.

Significant decrease in ATPase activity was observed in the muscles of the bivalves exposed to PoP as well as clay idols for 15 days as compared to control.

Mantle: In mantle of *Lamellidens marginalis* at 400 ppm for 10 days and 20 days exposure periods insignificant decrease was observed in ATPase activity. At 900 ppm after 10 days significant decrease was found whereas after 20 days insignificant change was observed as compared to control.

After 15 days exposure to PoP idol insignificant decrease was observed in ATPase activity in mantle whereas in clay idol no change was found in enzyme activity after 15 days as compared to control.

Gills: The ATPase activity in gills of *Lamellidens marginalis* in 400 ppm exposure for 10 days showed insignificant decrease but in the same concentration after 20 days it decreased significantly. In 900 ppm after 10 days as well as 20 days significant decrease was found in enzyme activity as compared to control.

ATPase activity was found to be decreased significantly in gills of the bivalves exposed to PoP as well as clay idols for 15 days as compared to control.

Foot: The ATPase activity in foot of *Lamellidens marginalis* in 400 ppm exposure for 10 days showed significant decrease whereas in the same concentration after 20 days it decreased insignificantly. At 900 ppm exposure for 10 days ATPase activity showed significant decrease whereas after 20 days insignificant decrease was found as compared to control.

ATPase activity was found to be decreased significantly in foot of the bivalves exposed to PoP as well as clay idols for 15 days as compared to control.

Hepatopancreas: In hepatopancreas of *Lamellidens marginalis* at 400 ppm exposure slight change was observed in ATPase activity after 10 days which was not significant but after 20 days significant increase was found. At 900 ppm after both the exposure periods insignificant decrease in ATPase activity was observed.

Hepatopancreas of the bivalves exposed to PoP and clay idols for 15 days showed significant decrease in ATPase activity as compared to control.

Gonads: The ATPase activity in the gonads of *Lamellidens marginalis* exposed to 400 ppm after 10 days and 20 days showed insignificant decrease as compared to control. In 900 ppm after 10 days and 20 days significant decrease was observed in ATPase activity in the gonads as compared to control.

After 15 days exposure to PoP and clay idol insignificant decrease was observed in ATPase activity in gonads as compared to control.

3.8.6 Lactate Dehydrogenase (Table 35,36 and Graph 39,40)

Muscles: In muscles of *Lamellidens marginalis* at 400 ppm and 900 ppm colour pigments after 10 days exposure significant decrease was found in LDH activity whereas after 20 days at both the concentrations insignificant decrease was observed in enzyme activity as compared to control.

Muscles showed significant decrease in LDH activity after exposure to PoP idol whereas in clay idol exposed bivalves, insignificant decrease in LDH activity was observed after 15 days as compared to control.

Mantle: In mantle of *Lamellidens marginalis*, insignificant decrease in LDH activity was found at 400 ppm and 900 ppm colour pigments after 10 days. After 20 days exposure significant decrease was observed at both the concentrations in enzyme activity as compared to control.

After 15 days exposure to PoP and clay idol insignificant decrease was observed in LDH activity in mantle of the bivalves as compared to control.

Gills: In gills of *Lamellidens marginalis* at 400 ppm colour pigments after 10 days exposure significant decrease was observed in LDH activity while after 20 days exposure insignificant decrease was found. At 900 ppm for both the exposure periods significant decrease was recorded in enzyme activity as compared to control.

In the gills of the bivalves exposed to PoP and clay idols for 15 days the LDH activity showed insignificant decrease as compared to control.

Foot: In foot, insignificant increase in LDH activity was found at 400 ppm and 900 ppm colour pigments after 10 days. After 20 days exposure significant increase was observed at both the concentrations in enzyme activity as compared to control.

Insignificant decrease in LDH activity in the foot of the bivalves was observed in PoP idol after 15 days while the activity showed insignificant increase in foot after the clay idol exposure as compared to control.

Hepatopancreas: In hepatopancreas of *Lamellidens marginalis*, at 400 ppm colour pigments after 10 days slight insignificant rise was found in LDH activity while after 20 days significant increase was found. At 900 ppm after 10 days enzyme activity increased significantly while after 20 days it showed insignificant rise as compared to control.

In hepatopancreas of the bivalves exposed to PoP idol insignificant decrease was found in LDH activity whereas in clay idol slight insignificant rise was observed in enzyme activity as compared to control.

Gonads: In gonads of *Lamellidens marginalis*, at 400 ppm colour pigments exposure insignificant change was observed after 10 days and 20 days. At 900 ppm exposure for 10 days significant decrease in LDH activity was observed whereas insignificant decrease was found after 20 days as compared to control.

Significant decrease in LDH activity was found in the gonads of the bivalves exposed to the PoP and clay idols for 15 days as compared to control.

3.9 Light microscopy

Histology of freshwater bivalve, *Lamellidens marginalis* was studied by light microscopy staining with Hematoxylene and counter stained by Eosin for the tissues like gills and hepatopancreas. Histology of these tissues were studied for control bivalve as well as the bivalves exposed to 400 ppm and 900 ppm concentrations of colour pigments for 10 days and 20 days period. Also light microscopic structure of these tissues were observed in the bivalves exposed to clay and Plaster of Paris idols.

3.9.1 Gills:

i) Control: (Fig. 1,2)

The light microscopic structure of the gills in the freshwater bivalve, *Lamellidens marginalis* lie on the either side of the body in the mantle cavity. Each gill showed two laminae as inner and outer lamina. Each gill lamina consists of an outer and inner lamella were elongated plate like structures (fig. 1,2). The cavity between gill lamellae was divided by vertical septa, the interlamellar junctions into a number of compartments i. e. water tubes. Each gill lamella showed numerous thin, vertical and parallel gill filaments. Adjacent gill filament of lamella remains connected by small horizontal bars called basal filaments. A gill filament showed lining of ciliated epithelium having secretary material. The connective tissue lies between the lamella and basal filament. The gill filament showed normal cavity as well as space between two gill filaments was also moderate (Fig. 1,2).

ii) 400 ppm 10 days exposure: (Fig. 3, 4)

The light microscopic structure of the gills of the bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments after 10 days showed clear changes in the histological structure. Elongated gill filaments with ciliated epithelial cells were observed. The cells showed a basal prominent nucleus. The cells also showed the accumulation of the dark material in the cytoplasm. The connective tissue was disintegrated with increased vacuolation. Increase in the filament cavity was also observed. The cavity between the two gill filaments was increased. The water tubes were elongated and interlamellar junctions were seen.

iii) 400 ppm 20 days exposure: (Fig. 5, 6)

The light microscopic structure of the gills of the bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments after 20 days

showed gill filament lined by ciliated epithelial cells and contain darkly stained material in the cytoplasm. The connective tissue showed increased vacuolation and disintegration. Increase in the filament cavity and interfilament cavity was observed. Elongated water tubes and interlamellar junctions were also prominent (Fig.5).

iv) 900 ppm 10 days exposure: (Fig. 7, 8)

The light microscopic structure of the gills of the bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments after 10 days showed gill filaments lined by ciliated epithelial cells (Fig. 8). The cells show more accumulation of darkly stained material in the cytoplasm. The connective tissue showed increased disintegration due to vacuolation. Increased filament cavity and interfilament cavity was also observed. Elongated water tubes and short interlamellar junctions were seen in the section (Fig.7).

v) 900 ppm 20 days exposure: (Fig. 9, 10)

The light microscopic structure of the gills of the bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments after 20 days showed gill filaments lined by ciliated epithelial cells with accumulation of dark material in the cytoplasm. (Fig.10). The connective tissue was observed with vacuolation due to disintegration (Fig.9). Gills showed increase in the filament cavity and interfilament cavity. Wide water tubes and short interlamellar junction were also observed (Fig.9).

vi) Clay idol 15 days exposure: (Fig. 11, 12)

The light microscopic structure of the gills of the bivalve, *Lamellidens marginalis* exposed to clay idol for 15 days showed minimum changes in the histological structure as compared to control. The gill filament lined by ciliated epithelium showed accumulation of darkly stained

clay particles (Fig. 12). The gill filaments showed normal histology with basal filament and intact connective tissue. The filament and interfilament cavity were also in normal condition. The structure of interlamellar junction and water tubes was found similar as that of control (Fig. 11).

vii) PoP idol 15 days exposure: (Fig. 13,14)

The light microscopic structure of the gills of the bivalve, *Lamellidens marginalis* exposed to PoP idol after 15 days showed elongated gill filaments lined by ciliated epithelium and accumulation of Plaster of Paris in filament cavity. Disintegration of connective tissue followed by vacuolation was observed (Fig. 14). Filament and interfilament cavity was increased. Wide irregularly shaped water tubes with short interlamellar junctions were the prominent changes observed in the section (Fig. 13).

3.9.2 Hepatopancreas:

i) Control : (Fig. 15, 16)

Light microscopic structure of hepatopancreas of control bivalve, *Lamellidens marginalis* showed loosely arranged digestive tubules. Two types of cells namely absorptive and secretory were lining the digestive tubules. Absorptive cells showed column like structure while secretory cells were dark and oval in shape. These two cell types were responsible for the absorption, secretion and intracellular digestion of food ingested. Each digestive tubule consisted wide lumen with secretory material. Digestive tubules were interconnected with each other by connective tissue.

ii) 400 ppm 10 days exposure: (Fig. 17, 18)

Light microscopic structure of hepatopancreas of the bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments for 10 days showed digestive tubules lined by absorptive and secretory cells. The lumen of the digestive tubule showed irregular and shrinked structure as compared to control. Disintegration of cells resulted in vacuolation of connective tissue was observed. Aggregation of the digestive tubules was observed (Fig.18).

iii) 400 ppm 20 days exposure: (Fig. 19, 20)

Light microscopic structure of hepatopancreas of the bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments for 20 days showed prominent irregularities in the digestive tubules as compared to 10 days exposure at 400 ppm. Digestive tubules lined by absorptive columnar cells and secretory globular cells were observed. Aggregation of tubules as clusters in at different locations in the section was noted. Decreased luminal cavity with irregular shape was noticed. Large vacuolations due to disintegration of the cells of the connective tissue were observed with increasing exposure period.

iv) 900 ppm 10 days exposure: (Fig. 21, 22)

The light microscopic structure of the hepatopancreas of the bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments for 10 days showed elongated irregularly shaped digestive tubules lined by columnar absorptive cells and globular secretory cells with dark coloured secretory material. The luminal cavity was found to be extremely reduced. The connective tissue with large vacuolations was observed. Increased concentration of colour pigments from 400 ppm to 900 ppm showed marked effects on the light microscopic structure of the hepatopancreas.

v) 900 ppm 20 days exposure: (Fig. 23, 24)

The light microscopic structure of the hepatopancreas of the bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments after 20 days showed significant changes in the histology as compared to the control and also the other concentrations and exposure periods. The digestive tubules observed were lined by absorptive and secretory cells. Almost closed luminal cavities due to shrinkage were observed in all the tubules. Disintegration and vacuolation in the connective tissue was seen prominently in this high concentration with long exposure period.

vi) Clay idol 15 days exposure: (Fig. 25, 26)

The light microscopic structure of the hepatopancreas of the bivalve, *Lamellidens marginalis* exposed to clay idol after 15 days showed minimum changes in the histological structure as compared to control. Digestive tubules lined by columnar absorptive cells and secretory globular cells were observed. The absorptive cells showed darkly stained material may be clay and secretory cells show vacuolations in the cytoplasm. The lumen was found in normal condition as in control. The connective tissue also showed less disintegration with small number and size of vacuoles.

vii) PoP idol 15 days exposure: (Fig. 27, 28)

The light microscopic structure of the hepatopancreas of the bivalve, *Lamellidens marginalis* exposed to PoP idol after 15 days showed almost similar structure as that of control. Minimum changes among all the concentrations and exposures were found in these PoP idol exposed bivalves' histology. Normal digestive tubules with columnar absorptive and globular secretory cells were observed. The luminal cavity was found with almost no disintegration and vacuolation. The connective tissue was also seen intact as in control.

Table 1: Number of idols immersed in selected water bodies in Kolhapur city

Year	Sites						
	Rankala Lake	Irani Khan	Panchganga Ghat	Rajaram Bandhara	Kotiteertha Lake	Rajaram Lake	Total
2005	14	160	574	91	80	36	955
2006	108	141	497	130	123	51	1000

(Source : DIG Office, Kasba Bawada, Kolhapur)

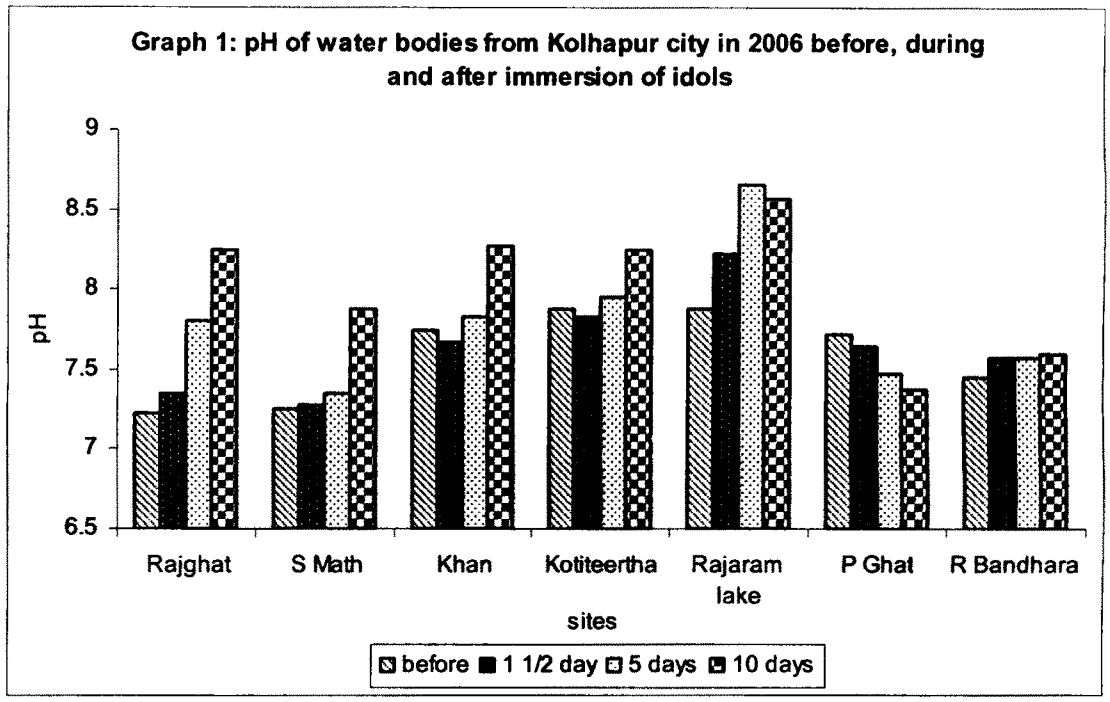
Table 2: Details of water bodies selected for the study

Details	Rankala Lake	Kotiteertha Lake	Rajaram Lake
Year of Construction	1887-1893	---	1928
Length of wall	3620 m	650 m	366 m
Depth	30 m	60 ft	11 m
Circumference	6 km	1.75 km	---
Area	107 hectare	57740 m3	21.6 hectare

(Source: Nandi, 2007)

Table 3: Pigment analysis

Element	Contents (ppm)
Calcium	2.806
Magnesium	3.003
Copper	1.342
Zinc	0.425
Chromium	0.048
Lead	0.085
Iron	1.359


Graph 1: pH of water bodies from Kolhapur city in 2006 before, during and after immersion of idols
9
8.5
8
7.5
7
6.5
pH
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

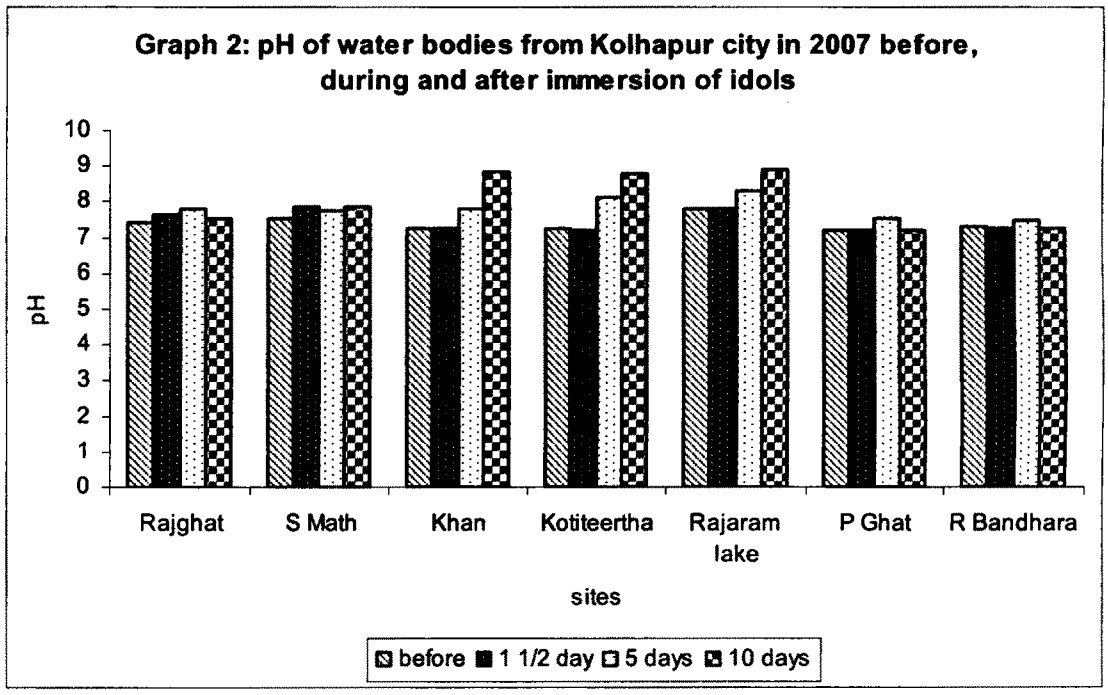
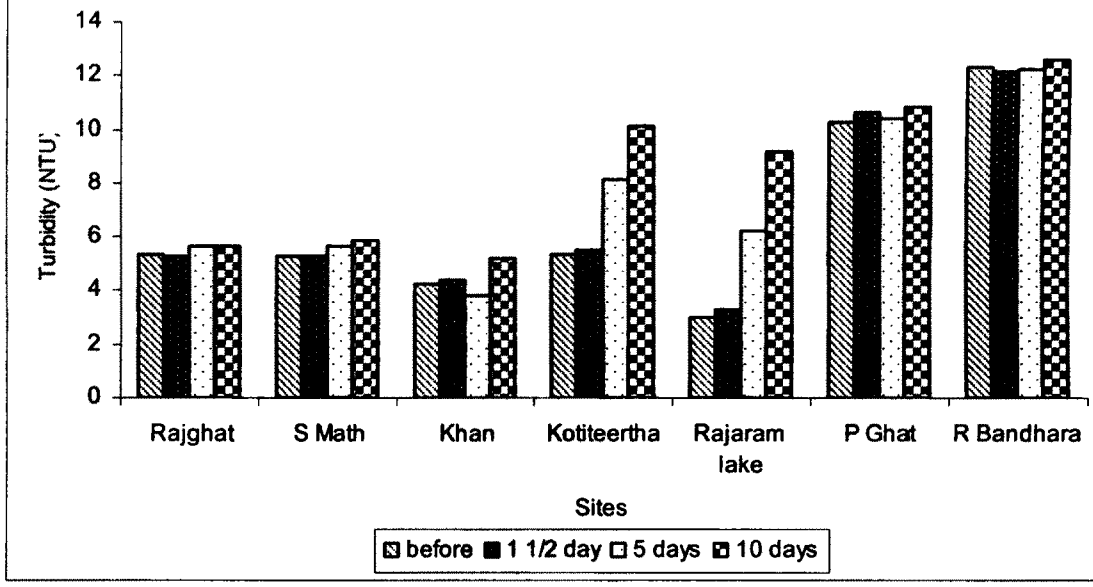

Graph 2: pH of water bodies from Kolhapur city in 2007 before, during and after immersion of idols
10
9
8
7
6
5
4
3
2
1
0
pH
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

Table 4: pH of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before Festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	7.225 ±0.05	7.35 ±0.05	7.8* ±0.08	8.25* ±0.05
	2007	7.42 ±0.09	7.65* ±0.20	7.8* ±0.14	7.52 ±0.25
Rankala Sandhyamath	2006	7.25 ±0.05	7.27 ±0.05	7.35* ±0.05	7.87* ±0.05
	2007	7.52 ±0.20	7.35 ±0.12	7.73* ±0.13	7.85* ±0.05
Irani Khan	2006	7.75 ±0.05	7.67 ±0.09	7.82 ±0.05	8.27* ±0.09
	2007	7.27 ±0.15	7.27 ±0.17	7.77 ±0.22	8.85* ±0.12
Kotiteertha Lake	2006	7.87 ±0.05	7.82 ±0.05	7.95 ±0.05	8.25* ±0.05
	2007	7.25 ±0.12	7.2 ±0.08	8.15* ±0.12	8.77* ±0.09
Rajaram Lake	2006	7.87 ±0.05	8.22 ±0.05	8.65* ±0.05	8.57* ±0.05
	2007	7.8 ±0.08	7.82 ±0.09	8.27 ±0.09	8.9* ±0.08
Panchganga Ghat	2006	7.72 ±0.05	7.65 ±0.05	7.47 ±0.1	7.37* ±0.1
	2007	7.2 ±0.08	7.17 ±0.09	7.55* ±0.23	7.21 ±0.08
Rajaram Bandhara	2006	7.45 ±0.05	7.57 ±0.05	7.57 ±0.05	7.6* ±0.08
	2007	7.32 ±0.09	7.23 ±0.08	7.5* ±0.08	7.27 ±0.10

Values are mean ± S.D. of 4 estimations.
* Significantly different from before.
*P< 0.05 by t-test.

Graph:3 Turbidity of water bodies from Kolhapur city in 2006 before, during and after the immersion of idols



Graph 4: Turbidity of water bodies from Kolhapur city in 2007 before, during and after immersion of idols

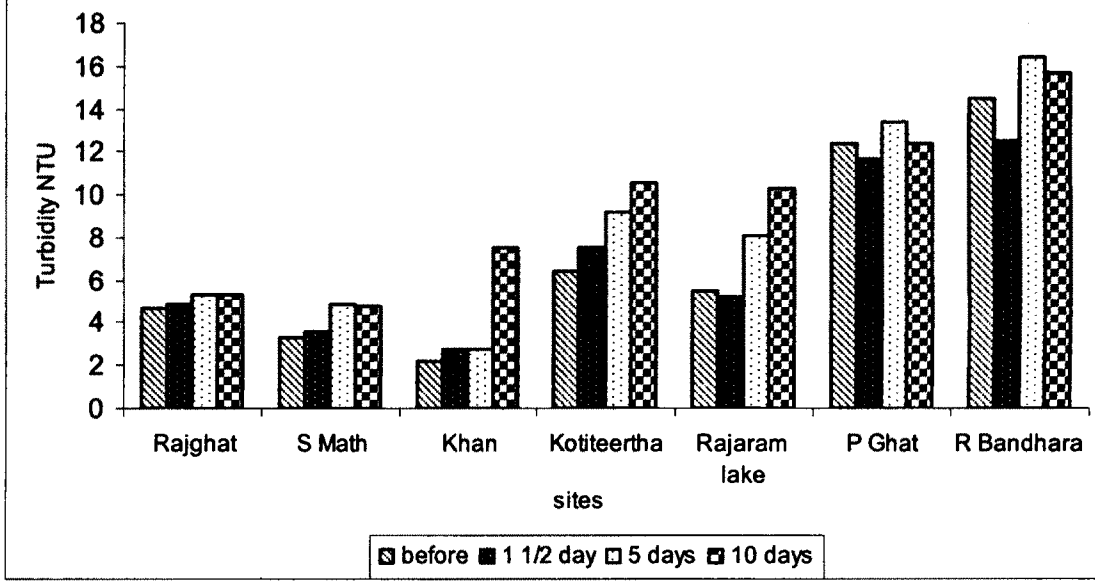
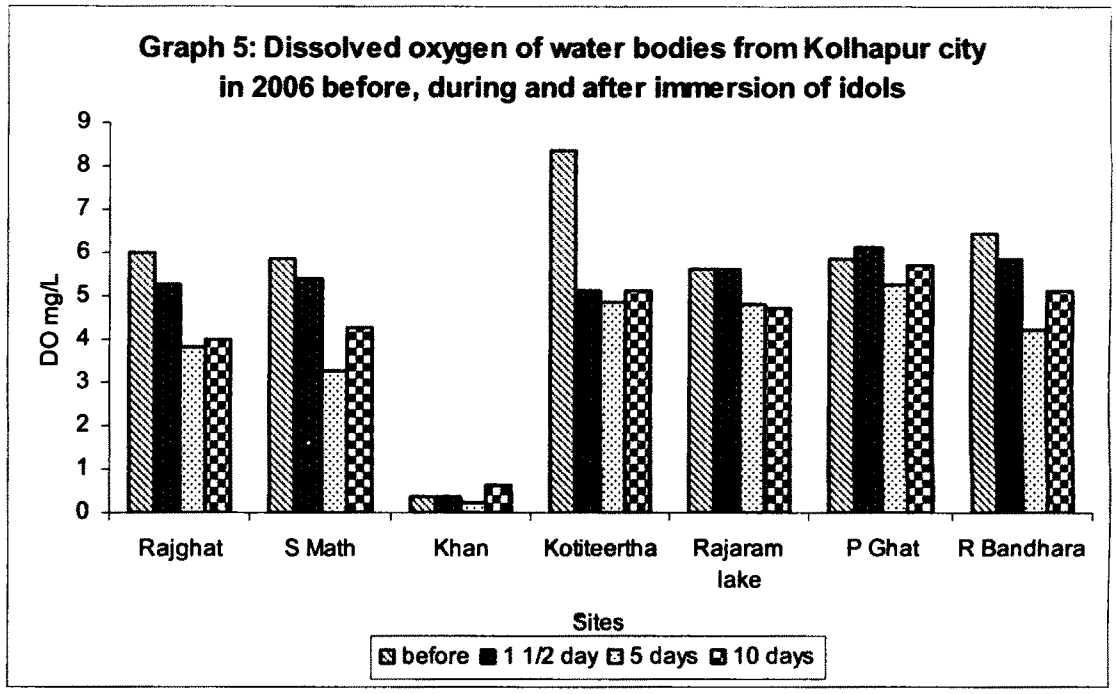


Table 5: Turbidity of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	5.35 ±0.20	5.27 ±0.08	5.62* ±0.14	5.67* ±0.08
	2007	4.7 ±0.08	4.82 ±0.09	5.32* ±0.09	5.3* ±0.08
Rankala Sandhyamath	2006	5.27 ±0.08	5.25 ±0.05	5.67* ±0.22	5.9* ±0.12
	2007	3.27 ±0.09	3.55 ±0.12	4.9* ±0.08	4.8* ±0.08
Irani Khan	2006	4.22 ±0.04	4.5 ±0.07	3.82* ±0.04	5.22* ±1.22
	2007	2.17 ±0.09	2.8 ±0.08	2.77 ±0.09	7.5* ±0.08
Kotiteertha Lake	2006	5.35 ±0.16	5.5 ±0.1	8.12* ±0.14	10.1* ±0.12
	2007	6.45 ±0.12	7.52 ±0.25	9.17* ±0.09	10.52* ±0.27
Rajaram Lake	2006	3.02 ±0.19	3.3 ±0.07	6.22* ±0.04	9.17* ±0.14
	2007	5.52 0.27	5.25 0.12	8.1* 0.08	10.32* 0.15
Panchganga Ghat	2006	10.27 ±0.08	10.6 ±0.07	10.72 ±0.14	±10.87* 0.19
	2007	12.37 ±0.37	11.67 ±0.26	13.45* ±0.20	12.4 ±0.08
Rajaram Bandhara	2006	12.3 ±0.14	12.17 ±0.12	12.7* ±0.07	12.57* ±0.08
	2007	14.47 ±0.20	12.5 ±0.21	16.47* ±0.09	15.7* ±0.08

All values are expressed in NTU
Values are mean ± S.D. of 4 estimations.
* Significantly different from before.
*P< 0.05 by t-test


Graph 5: Dissolved oxygen of water bodies from Kolhapur city in 2006 before, during and after immersion of idols
DO mg/L
0
1
2
3
4
5
6
7
8
9
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
Sites
before
1 1/2 day
5 days
10 days

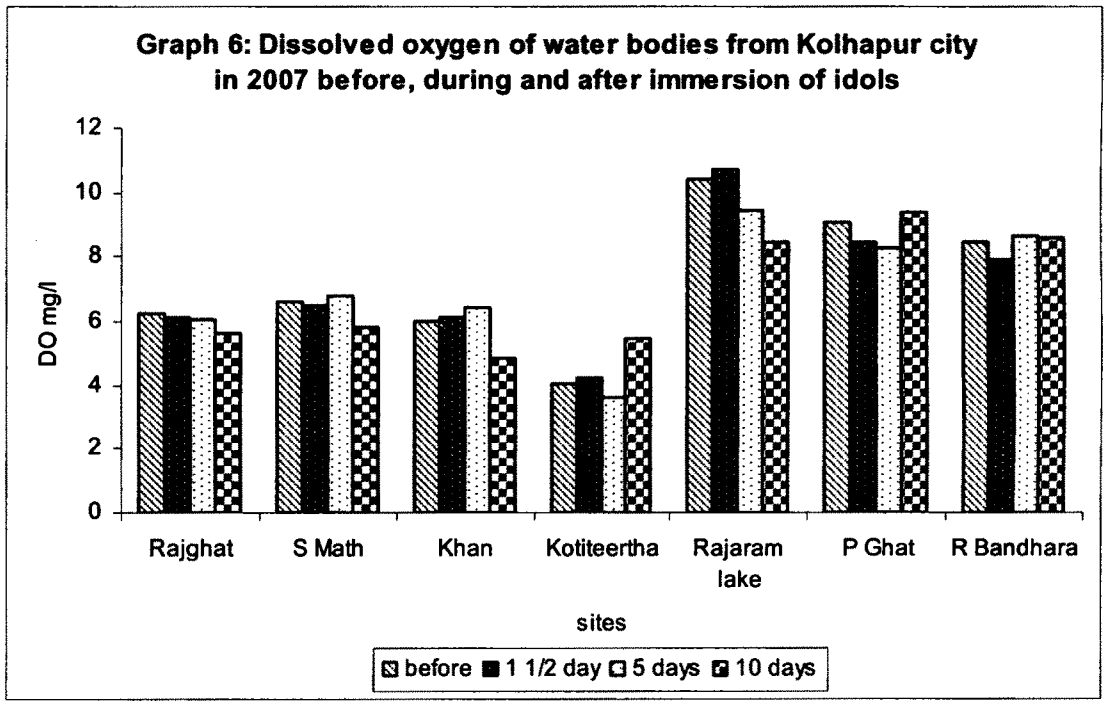
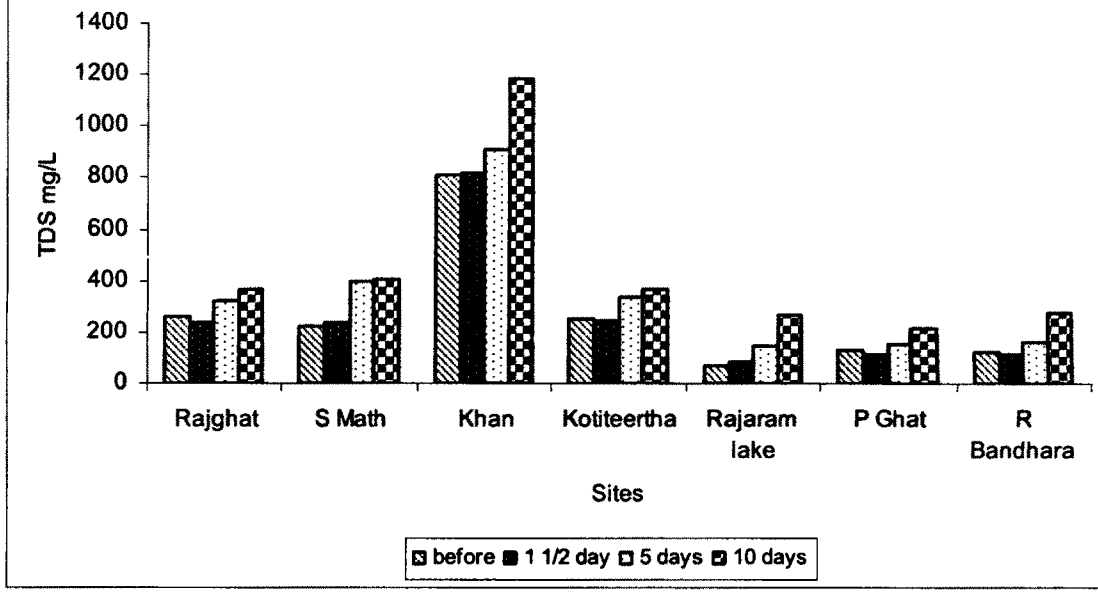

Graph 6: Dissolved oxygen of water bodies from Kolhapur city in 2007 before, during and after immersion of idols
DO mg/l
0
2
4
6
8
10
12
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

Table 6: Dissolved oxygen of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	6.02 ±0.008	5.27 ±0.008	3.83* ±0.005	4.01* ±0.005
	2007	6.23 ±0.01	6.13 ±0.008	6.04 ±0.009	5.61* ±0.01
Rankala Sandhyamath	2006	5.87 ±0.009	5.39 ±0.005	3.25* ±0.005	4.26* ±0.005
	2007	6.64 ±0.008	6.51 ±0.01	6.82 ±0.01	5.83* ±0.02
Irani Khan	2006	0.35 ±0.05	0.35 ±0.05	0.25 ±0.05	0.64* ±0.005
	2007	6.02 ±0.01	6.12 ±0.01	6.43 ±0.01	4.83* ±0.01
Kotiteertha Lake	2006	8.36 ±0.005	5.12* ±0.09	4.85* ±0.05	5.15* ±0.05
	2007	4.03 ±0.01	4.22 ±0.009	3.61* ±0.01	5.42* ±0.02
Rajaram Lake	2006	5.65 ±0.005	5.65 ±0.005	4.83* ±0.50	4.72* ±0.005
	2007	10.40 ±0.11	10.70 ±0.22	9.45 ±0.009	8.46* ±0.01
Panchganga Ghat	2006	5.88 ±0.005	6.14 ±0.005	5.28* ±0.005	5.72 ±0.005
	2007	9.05 ±0.008	8.43* ±0.01	8.25* ±0.009	9.34 ±0.06
Rajaram Bandhara	2006	6.45 ±0.05	5.85 ±0.05	4.25* ±0.05	5.15* ±0.05
	2007	8.45 ±0.01	7.92* ±0.009	8.65 ±0.01	8.55 ±0.30

All values are expressed in mg/l
Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test

Graph 7: Total dissolved solids of water bodies in Kolhapur city in 2006 before, during and after immersion of idols



Graph 8: Total dissolved solids of water bodies from Kolhapur city in 2007 before, durind and after immersion of idols

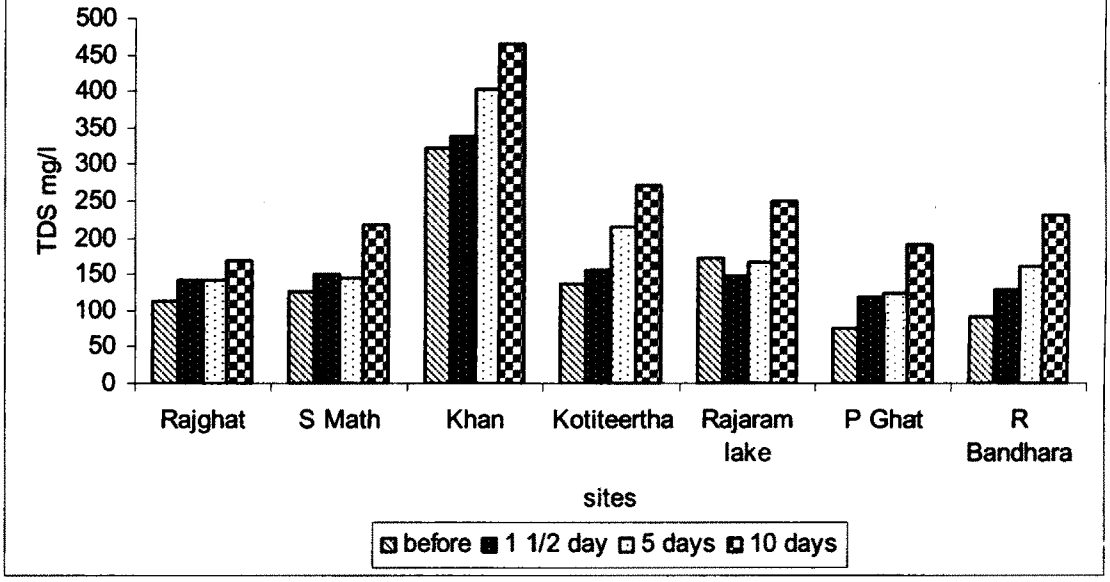
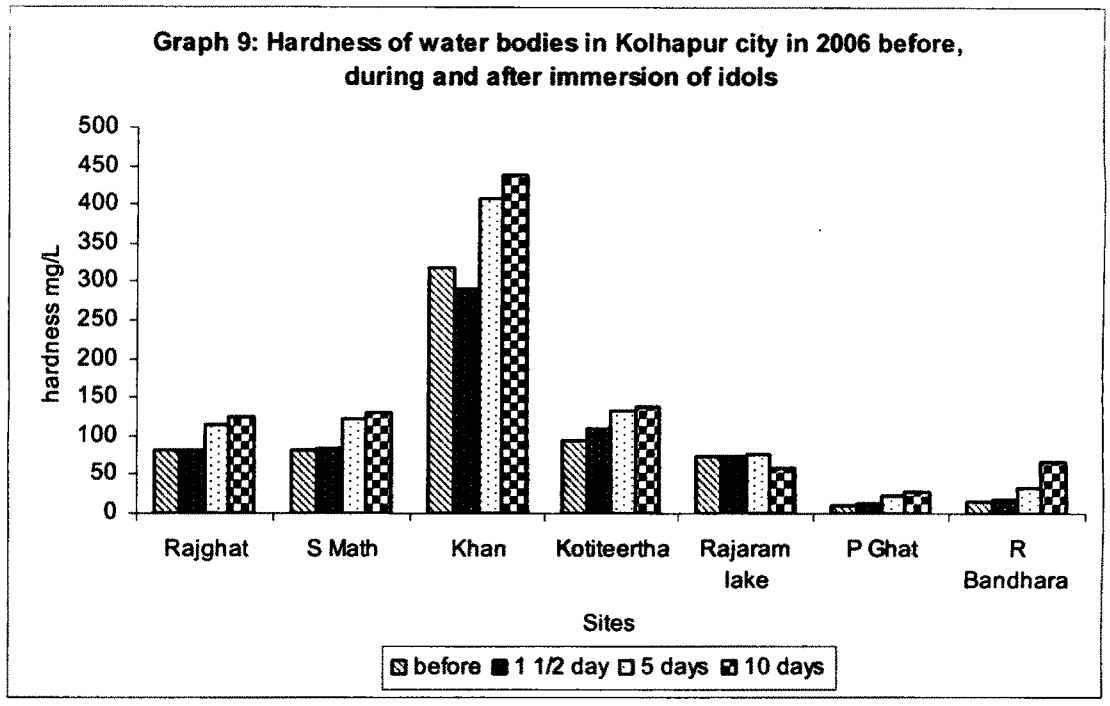


Table 7: Total dissolved solids of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	257.5 ±8.29	235* ±8.66	325* ±25	367.5* ±10.89
	2007	113.75 ±4.78	143.75* ±8.53	141.25 ±8.53	168.75* ±8.53
Rankala Sandhyamath	2006	218.75 ±5.44	240* ±18.7	396.25* ±25.34	405* ±11.18
	2007	126.25 ±11.08	151.25* ±6.29	146.25* ±11.08	218.75* ±8.53
Irani Khan	2006	810 ±12.24	817.5 ±43.22	907.5* ±10.89	1182.5* ±24.87
	2007	321.25 ±8.53	337.5 ±13.22	403.75* ±11.08	466.25* ±4.78
Kotiteertha Lake	2006	251.25 ±22.46	247.5 ±7.5	340* ±12.24	370* ±7.9
	2007	137.5 ±6.45	155* ±5.77	213.75* ±12.5	272.5* ±10.4
Rajaram Lake	2006	72.5 ±4.3	85* ±18.02	148.75* ±7.39	270.0* ±32.40
	2007	171.25 ±8.53	147.5* ±6.45	166.25 ±4.78	251.25* ±8.53
Panchganga Ghat	2006	127.5 ±8.29	112.5 ±19.2	155* ±21.79	215* ±21.7
	2007	76.25 ±4.78	117.5* ±9.57	123.75* ±4.78	191.25* ±13.14
Rajaram Bandhara	2006	125 ±28.72	115 ±20.6	157.5* ±14.7	275* ±21.79
	2007	92.5 ±6.45	128.75* ±8.53	162.5* ±6.45	231.25* ±8.53

All values are expressed in mg/l
Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test


Graph 9: Hardness of water bodies in Kolhapur city in 2006 before, during and after immersion of idols
hardness mg/L
500
450
400
350
300
250
200
150
100
50
0
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
Sites
before
1 1/2 day
5 days
10 days

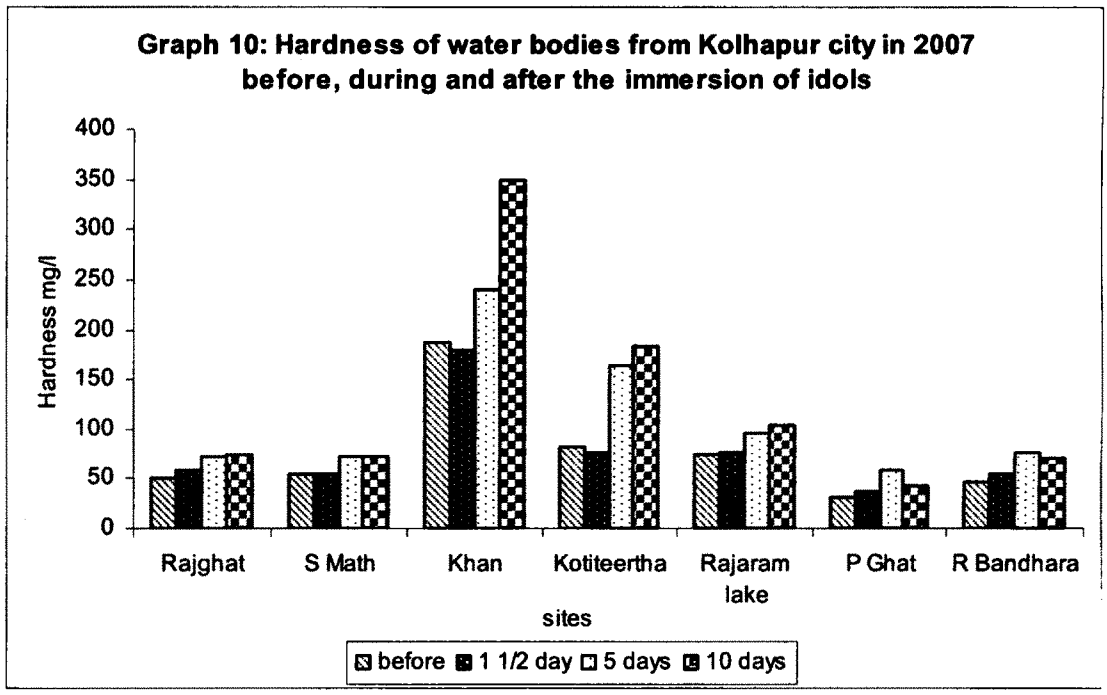
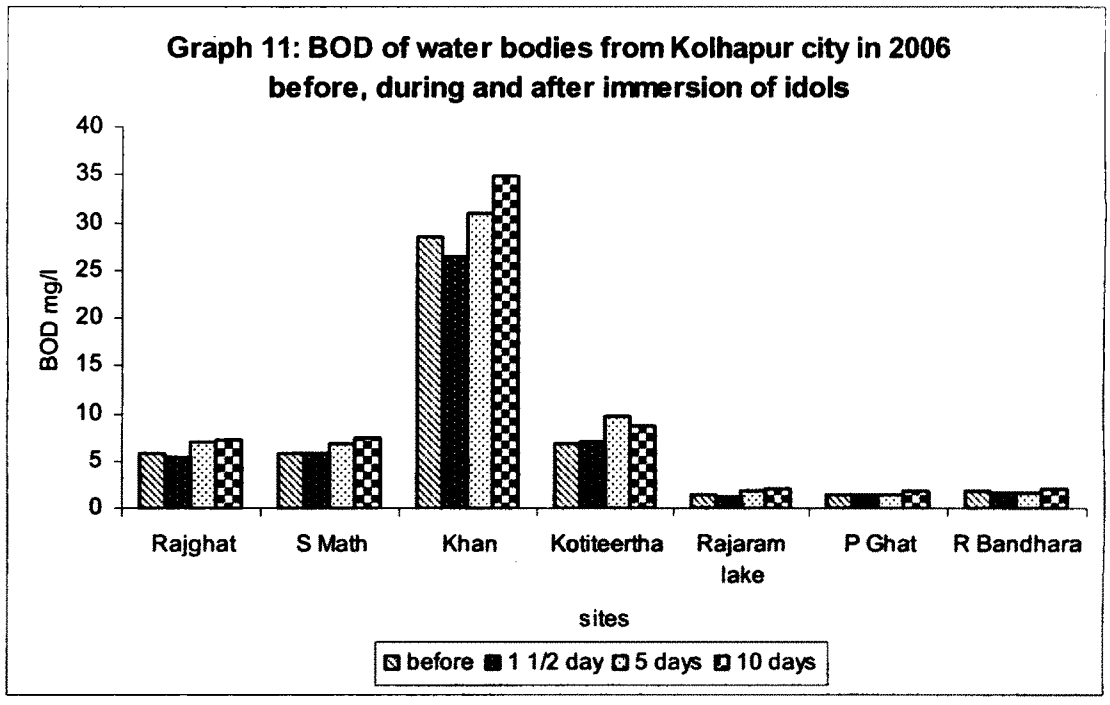

Graph 10: Hardness of water bodies from Kolhapur city in 2007 before, during and after the immersion of idols
Hardness mg/l
400
350
300
250
200
150
100
50
0
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

Table 8: Hardness of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	80.5 ±2.51	81 ±2.58	114* ±1.63	125* ±3.82
	2007	51.5 ±1.0	58.25 ±3.86	71.25* ±0.95	74.0* ±0.81
Rankala Sandhyamath	2006	81 ±3.46	83 ±2.58	122.5* ±4.43	130.5* ±4.43
	2007	54.75 ±0.95	54.5 ±5.19	72.75* ±2.21	72.75* ±0.95
Irani Khan	2006	318 ±1.63	291* ±54.58	407.5* ±4.12	438.5* ±2.51
	2007	186.5 ±9.14	179.0 ±15.09	240.0* ±3.26	350.0* ±20.59
Kotiteertha Lake	2006	94.5 ±2.51	109 ±3.46	132* ±1.63	138* ±1.63
	2007	81.0 ±3.46	75.5 ±3.41	164.5* ±3.41	182.5* ±5.50
Rajaram Lake	2006	74.5 ±1.91	73.5 ±1.0	77.0 ±2.0	58* ±4.32
	2007	73.5 1.91	77.0 2.58	95.5* 3.41	103.5* 9.29
Panchganga Ghat	2006	11 ±2.58	12 ±3.65	23* ±4.16	27.5* ±3.41
	2007	31.0 ±2.58	36.5 ±5.0	59.0* ±2.58	43.0* ±2.58
Rajaram Bandhara	2006	15.5 ±3.41	17.5 ±5.25	32* ±0.001	67* ±2.0
	2007	46.0 ±3.65	55.0* ±2.58	77.0* ±2.58	71.0* ±2.58

All values are expressed in mg/l
Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test


Graph 11: BOD of water bodies from Kolhapur city in 2006 before, during and after immersion of idols
BOD mg/l
40
35
30
25
20
15
10
5
0
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

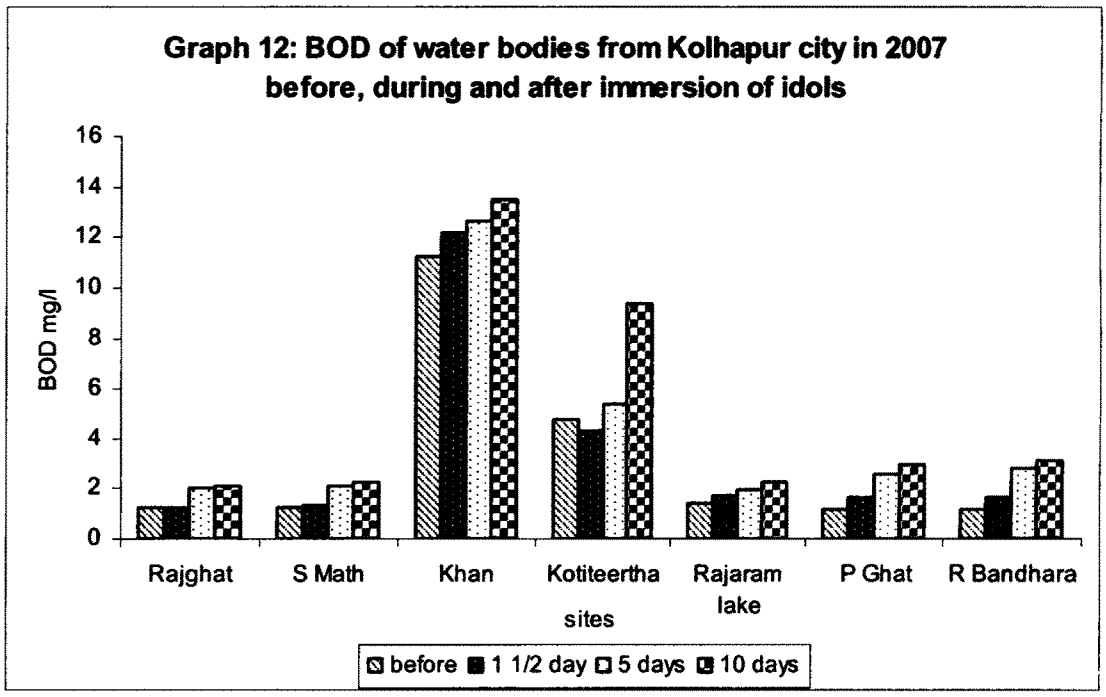
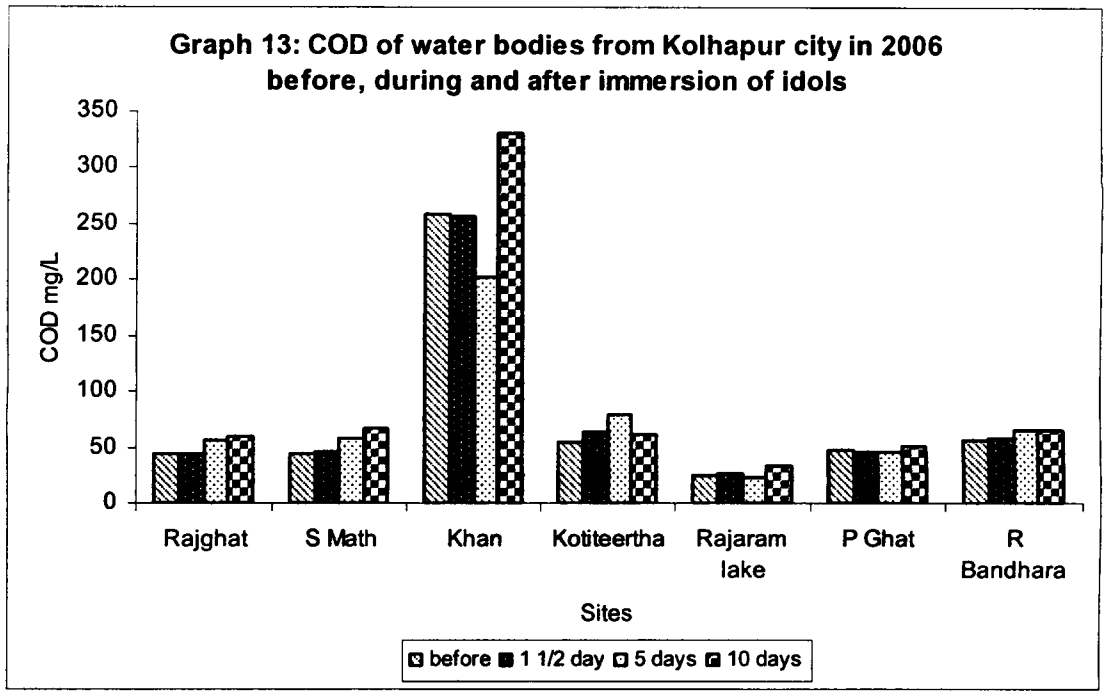

Graph 12: BOD of water bodies from Kolhapur city in 2007 before, during and after immersion of idols
BOD mg/l
16
14
12
10
8
6
4
2
0
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

Table 9: Biochemical oxygen demand of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	5.82 ±0.08	5.37 ±0.06	6.92* ±0.06	7.21* ±0.07
	2007	1.25 ±0.12	1.25 ±0.12	2.04* ±0.03	2.14* ±0.008
Rankala Sandhyamath	2006	5.86 ±0.05	5.82 ±0.06	6.71* ±0.06	7.45* ±0.04
	2007	1.25 ±0.12	1.35 ±0.12	2.10* ±0.13	2.23* ±0.18
Irani Khan	2006	28.51 ±0.40	26.39 ±0.08	30.83* ±0.06	34.86* ±0.08
	2007	11.22 ±0.17	12.17 ±0.09	12.67 ±0.09	13.5* ±0.08
Kotiteertha Lake	2006	6.78 ±0.05	6.91 ±0.02	9.64* ±0.02	8.57* ±0.02
	2007	4.75 ±0.12	4.27 ±0.009	5.35* ±0.05	9.38* ±0.19
Rajaram Lake	2006	1.35 ±0.03	1.25 ±0.01	1.87* ±0.02	2.14* ±0.04
	2007	1.43 ±0.04	1.75 ±0.03	1.94* ±0.02	2.28* ±0.08
Panchganga Ghat	2006	1.41 ±0.08	1.35 ±0.04	1.40 ±0.07	1.83* ±0.01
	2007	1.14 ±0.01	1.60 ±0.03	2.55* ±0.12	3.0* ±0.08
Rajaram Bandhara	2006	1.82 ±0.04	1.72 ±0.03	1.66* ±0.03	2.06* ±0.02
	2007	1.17 ±0.02	1.61 ±0.01	2.78* ±0.08	3.12* ±0.06

All values are expressed in mg/l
Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test


Graph 13: COD of water bodies from Kolhapur city in 2006 before, during and after immersion of idols
350
300
250
200
150
100
50
0
COD mg/L
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
Sites
before
1 1/2 day
5 days
10 days

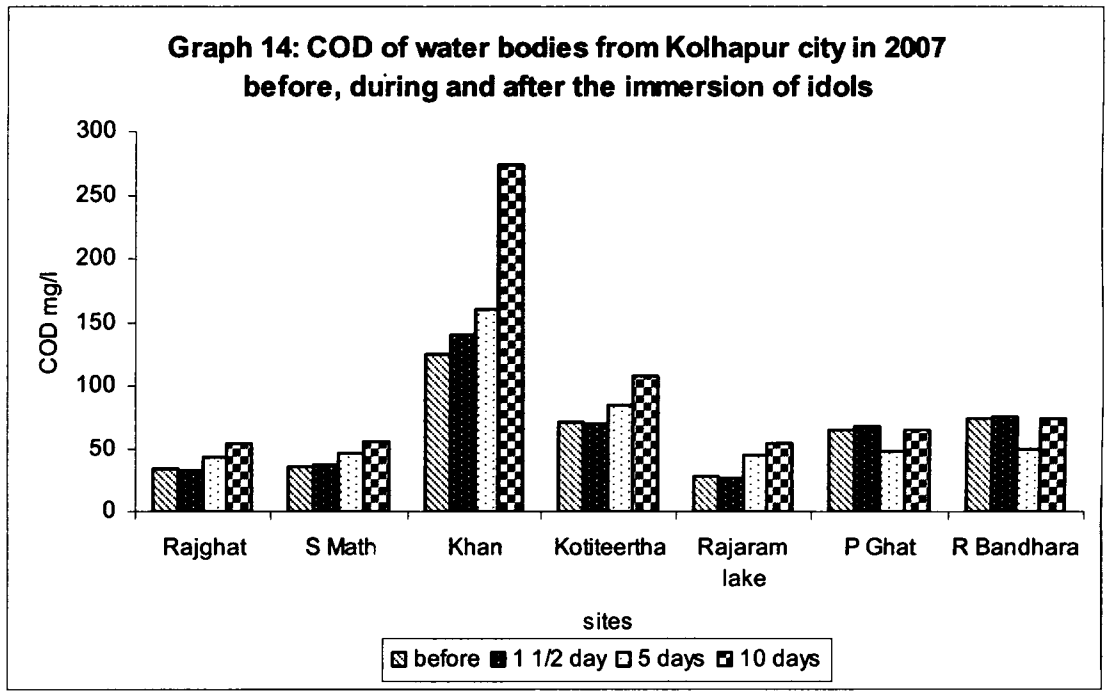
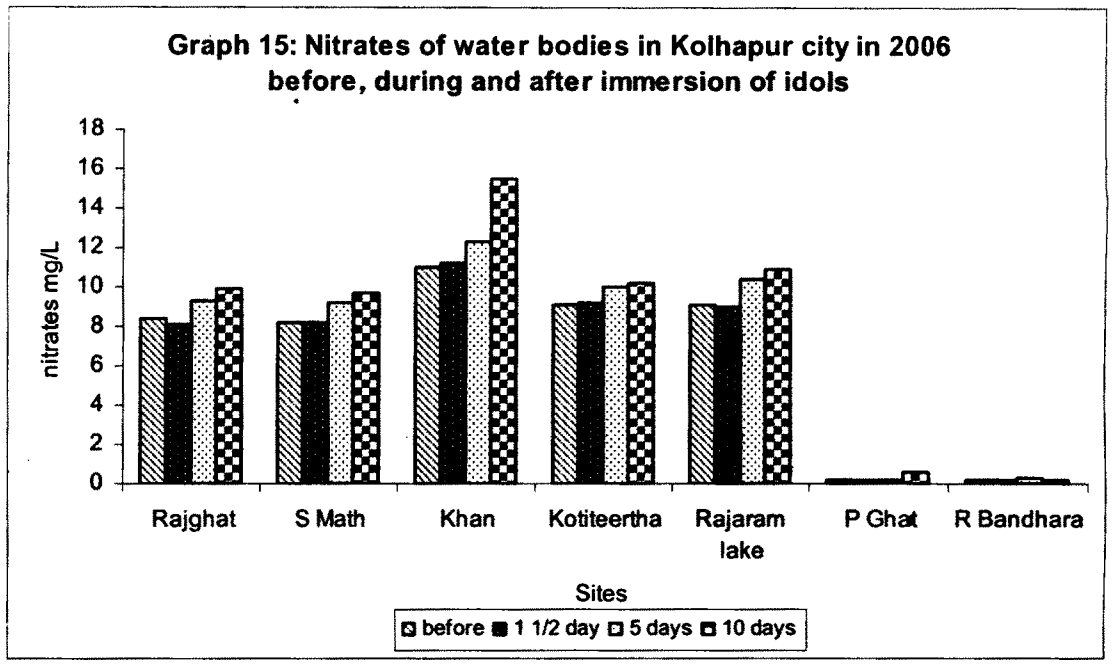

Graph 14: COD of water bodies from Kolhapur city in 2007 before, during and after the immersion of idols
300
250
200
150
100
50
0
COD mg/l
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

Table 10: Chemical oxygen demand of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	43.55 ±1.86	43.35 ±2.77	56.42* ±1.55	60.39* ±0.15
	2007	34.0 ±1.63	33.0 ±2.58	43.75* ±1.70	54.5* ±3.0
Rankala Sandhyamath	2006	43.43 ±1.06	45 ±1.67	58.6* ±0.42	67.31* ±3.83
	2007	35.0 ±3.46	36.25 ±3.5	45.5* ±2.38	55.25* ±2.62
Irani Khan	2006	258.5 ±16.6	256.5 ±27.7	203* ±12.05	331.5* ±13.5
	2007	125.25 ±6.70	140.5 ±11.35	160.25* ±3.86	274.0* ±28.61
Kotiteertha Lake	2006	55.0 ±2.58	63.0* ±1.15	79.0* ±2.58	61.5* ±16.11
	2007	71.5 ±6.60	68.75 ±5.90	85.0* ±2.58	107.5* ±7.18
Rajaram Lake	2006	25.5 ±1.91	27.0 ±2.58	22.0 ±1.63	33.0* ±1.15
	2007	27.0 ±2.58	25.75 ±1.70	44.25* ±4.34	53.75* ±2.87
Panchganga Ghat	2006	46.64 ±7.11	45.5 ±2.51	45.0 ±2.58	50.16 ±1.44
	2007	65.0 ±2.58	67.5 ±5.19	48.0* ±5.65	65.0 ±2.58
Rajaram Bandhara	2006	57.0 ±2.58	57.5 ±6.19	65.5 ±1.91	64.5 ±8.69
	2007	74.5 ±2.51	74.75 ±2.5	48.5* ±7.54	74.25 ±4.64

All values are expressed in mg/l
Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test


Graph 15: Nitrates of water bodies in Kolhapur city in 2006 before, during and after immersion of idols
nitrates mg/L
18
16
14
12
10
8
6
4
2
0
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
Sites
before
1 1/2 day
5 days
10 days

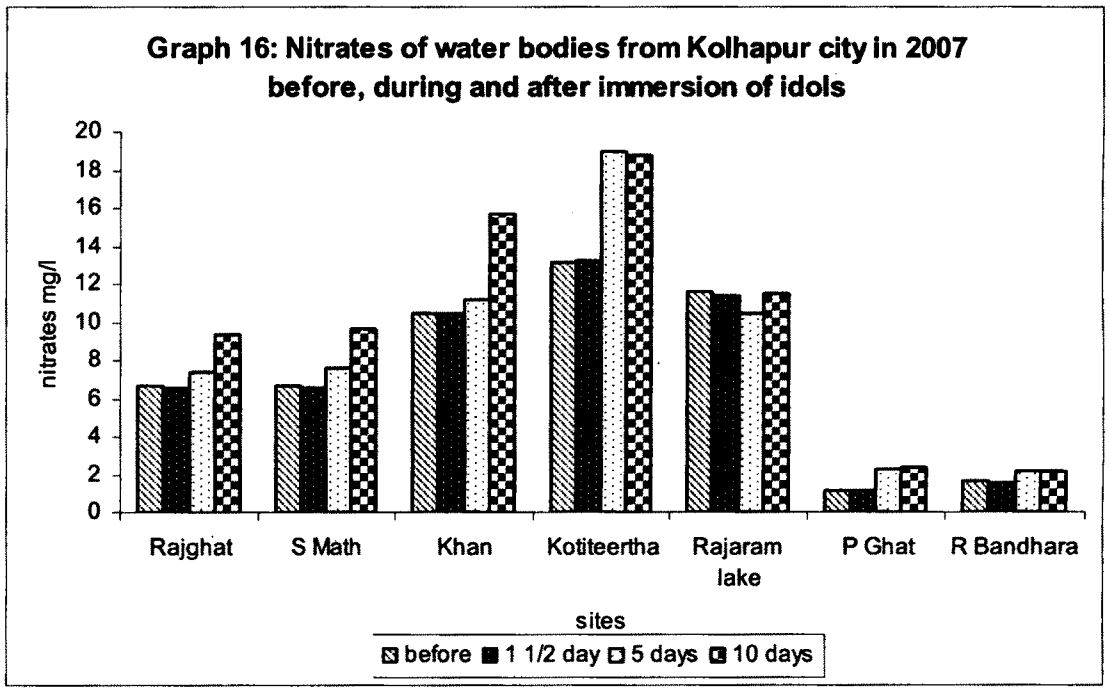
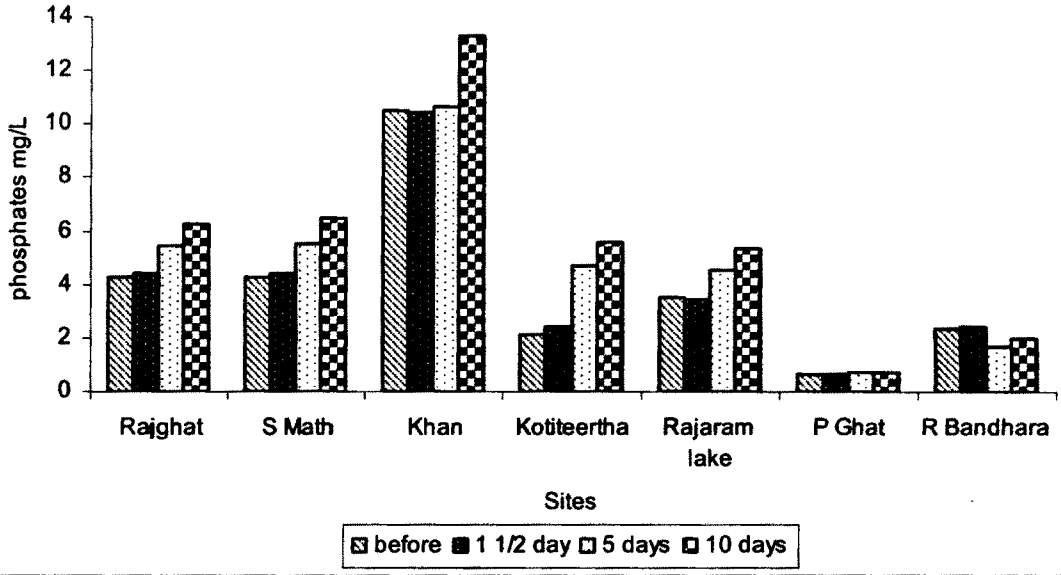

Graph 16: Nitrates of water bodies from Kolhapur city in 2007 before, during and after immersion of idols
nitrates mg/l
20
18
16
14
12
10
8
6
4
2
0
Rajghat
S Math
Khan
Kotiteertha
Rajaram lake
P Ghat
R Bandhara
sites
before
1 1/2 day
5 days
10 days

Table 11: Nitrates of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	8.37 ±0.61	8.1 ±0.29	9.32* ±0.15	9.93* ±0.12
	2007	6.64 ±0.16	6.52 ±0.03	7.38* ±0.35	9.33* ±0.04
Rankala Sandhyamath	2006	8.2 ±0.49	8.19 ±0.09	9.23* ±0.83	9.73* ±0.99
	2007	6.69 ±0.26	6.54 ±0.22	7.56* ±0.25	9.66* ±0.36
Irani Khan	2006	11.00 ±0.97	11.24 ±0.74	12.26* ±0.22	15.49* ±0.27
	2007	10.45 ±0.30	10.44 ±0.14	11.22 ±0.17	15.74* ±0.26
Kotiteertha Lake	2006	9.13 ±0.12	9.24 ±0.24	9.96 ±0.06	10.22* ±0.12
	2007	13.15 ±0.09	13.26 ±0.09	18.96* ±0.23	18.80* ±1.44
Rajaram Lake	2006	9.11 ±0.55	8.96 ±0.48	10.43* ±0.20	10.91* ±0.61
	2007	11.64 ±0.06	11.35 ±0.29	10.43* ±0.31	11.52* ±0.95
Panchganga Ghat	2006	0.21 ±0.04	0.24 ±0.04	0.23 ±0.05	0.64 ±0.5
	2007	1.16 ±0.08	1.16 ±0.26	2.24 ±0.18	2.33* ±0.34
Rajaram Bandhara	2006	0.19 ±0.04	0.17 ±0.02	0.33* ±0.1	0.24* ±0.04
	2007	1.64 ±0.02	1.49 ±0.27	2.15* ±0.21	2.14* ±0.20

All values are expressed in mg/l
Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test

Graph 17: Phosphates of water bodies from Kolhapur city in 2006 before, during and after immersion of idols



Graph 18: Phosphates of water bodies from Kolhapur city in 2007 before, during and after immersion of idols

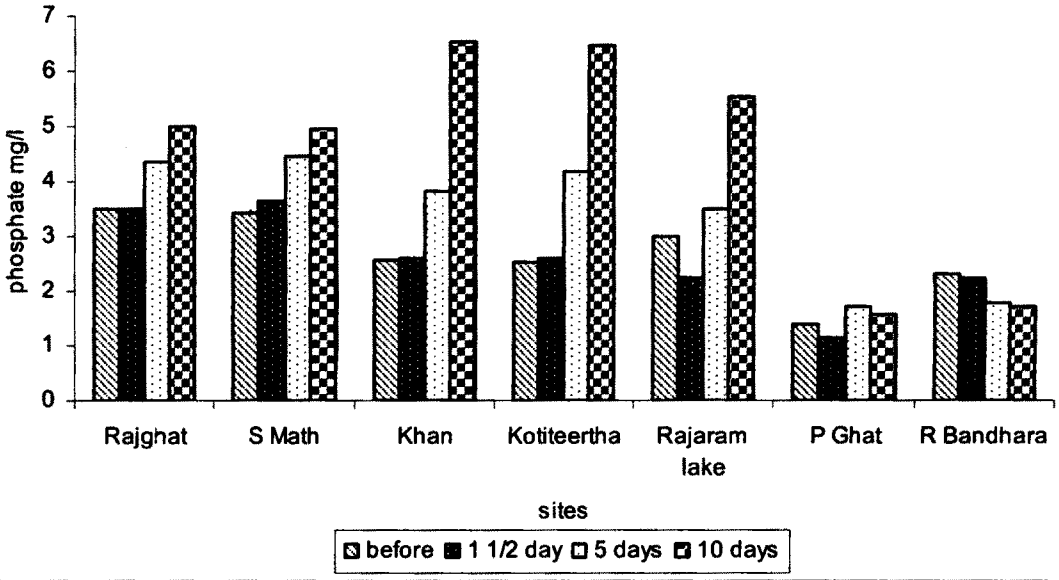
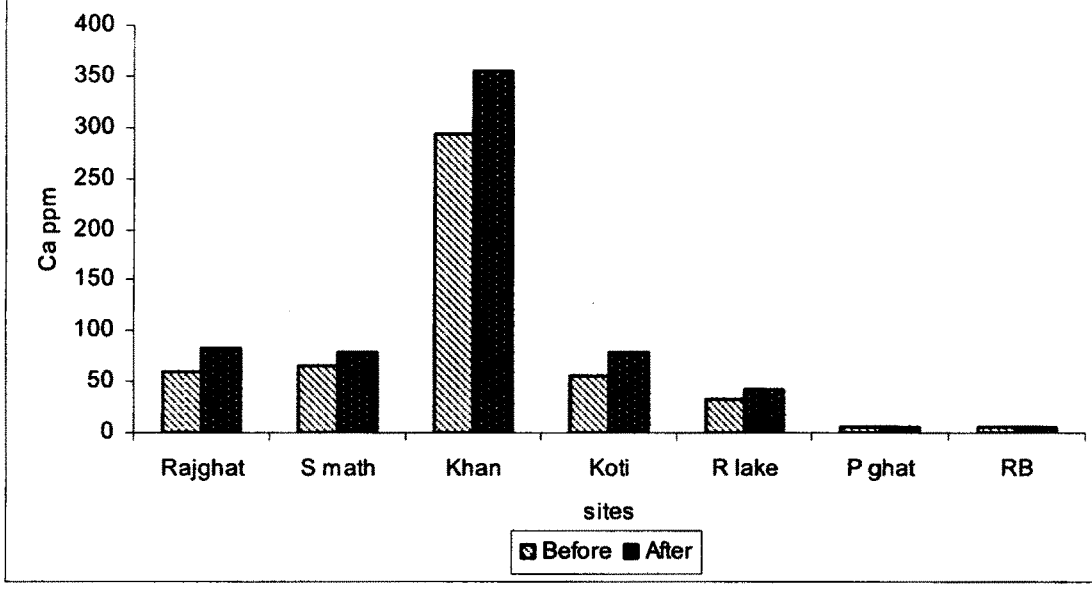


Table 12: Phosphates of water bodies from Kolhapur city before, during and after the festival

Site	Year	Before festival	1 ½ day	5 days	10 days
Rankala Rajghat	2006	4.24 ±0.19	4.42 ±0.40	5.43* ±0.77	6.29* ±0.69
	2007	3.49 ±0.07	3.51 ±0.10	4.34* ±0.03	4.99* ±0.48
Rankala Sandhyamath	2006	4.3 ±0.05	4.44 ±0.23	5.52* ±0.46	6.45* ±0.53
	2007	3.44 ±0.39	3.65 ±0.13	4.44* ±0.16	4.96* ±0.47
Irani Khan	2006	10.54 ±0.35	10.50 ±0.25	10.67 ±0.37	13.32* ±0.49
	2007	2.58 ±0.08	2.61 ±0.25	3.83* ±0.11	6.53* ±0.27
Kotiteertha Lake	2006	2.14 ±0.09	2.41 ±0.46	4.74* ±0.15	5.56* ±0.32
	2007	2.54 ±0.17	2.59 ±0.26	4.19* ±0.13	6.46* ±0.19
Rajaram Lake	2006	3.53 ±0.38	3.49 ±0.32	4.59* ±0.44	5.39* ±0.20
	2007	2.98 ±0.94	2.23 ±0.22	3.51 ±0.06	5.52* ±0.31
Panchganga Ghat	2006	1.03 ±0.12	0.63* ±0.30	0.72* ±0.19	0.76* ±0.04
	2007	1.39 ±0.10	1.15 ±0.21	1.72 ±0.82	1.56 ±0.63
Rajaram Bandhara	2006	2.37 ±0.25	2.4 ±0.21	1.71* ±0.28	1.97* ±0.27
	2007	2.32 ±0.13	2.24 ±0.17	1.78 ±0.53	1.72 ±0.70

All values are expressed in mg/l
Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test

Graph 19: Calcium content of water bodies from Kolhapur city before, during and after the immersion of idols



Graph 20: Magnesium content of water bodies from Kolhapur city before, during and after immersion of idols

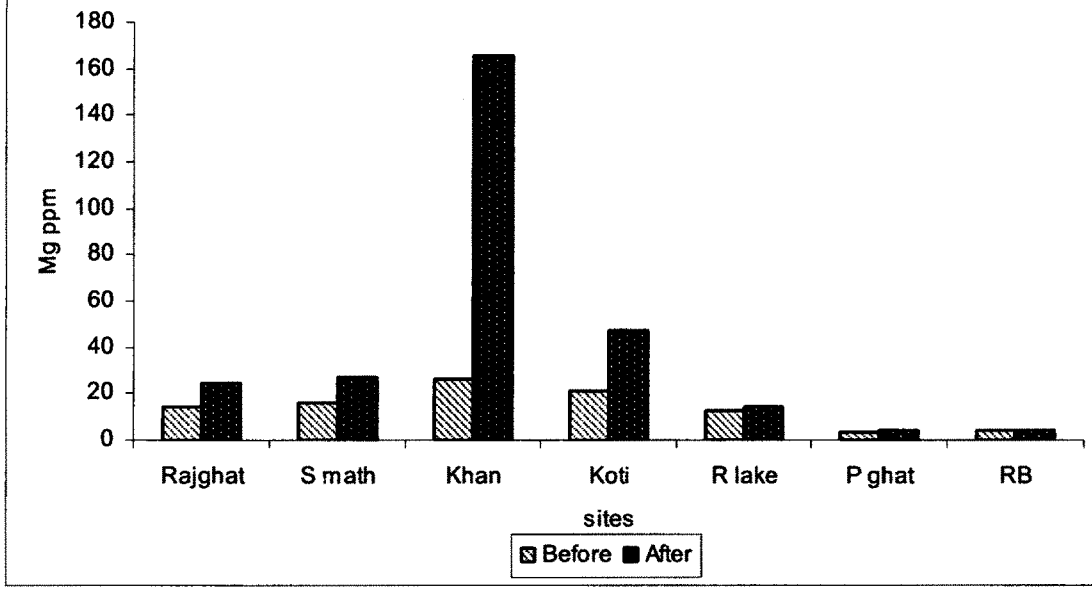


Table 13: Ca and Mg levels of water bodies from Kolhapur city before and after the idol immersion

Site	Calcium (ppm)		Magnesium (ppm)	
Sample	Before festival	After festival	Before festival	After festival
Rajghat	60.25 ±0.12	82.37* ±0.45	14.05 ±0.31	24.8* ±0.49
Sandhyamath	65.15 ±1.17	78.6* ±1.34	15.87 ±0.25	27.05* ±0.40
Irani Khan	294.5 ±2.88	354.62* ±1.37	26.4 ±0.53	165.25* ±0.64
Kotiteertha Lake	56.15 ±0.65	79.12* ±0.90	21.07 ±0.60	47.12* ±1.11
Rajaram Lake	32.06 ±18.71	41.67 ±0.53	13.05 ±0.66	14.2* ±0.54
Panchganga Ghat	5.72 ±0.51	6.6* ±0.54	3.55 ±0.31	4.05* ±0.31
Rajaram Bandhara	5.77 ±0.37	6.75* ±0.38	4.42 ±0.33	4.5 ±0.29

Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test

Table 14: Copper and Lead levels of water bodies from Kolhapur city before and after the idol immersion

Site	Cu(ppm)		Pb(ppm)	
Sample	Before festival	After festival	Before festival	After festival
Rajghat	0.25 ±0.005	0.31* ±0.008	0.028 ±0.0008	0.21* ±0.001
Sandhyamath	0.25 ±0.01	0.32* ±0.008	0.027 ±0.001	0.28* ±0.01
Irani Khan	6.24 ±0.008	38.61* ±0.46	0.42 ±0.002	8.38* ±0.01
Kotiteertha Lake	0.85 ±0.01	1.53* ±0.01	0.086 ±0.0009	0.37* ±0.004
Rajaram Lake	0.44 ±0.009	0.55* ±0.012	0.045 ±0.001	0.12* ±0.002
Panchganga Ghat	0.027 ±0.009	0.24* ±0.01	0.002 ±0.0005	0.017* ±0.0009
Rajaram Bandhara	0.03 ±0.008	0.28* ±0.01	0.016 ±0.0008	0.024* ±0.001

Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test

Table 15: Zinc and Chromium levels of water bodies from Kolhapur city before and after the idol immersion

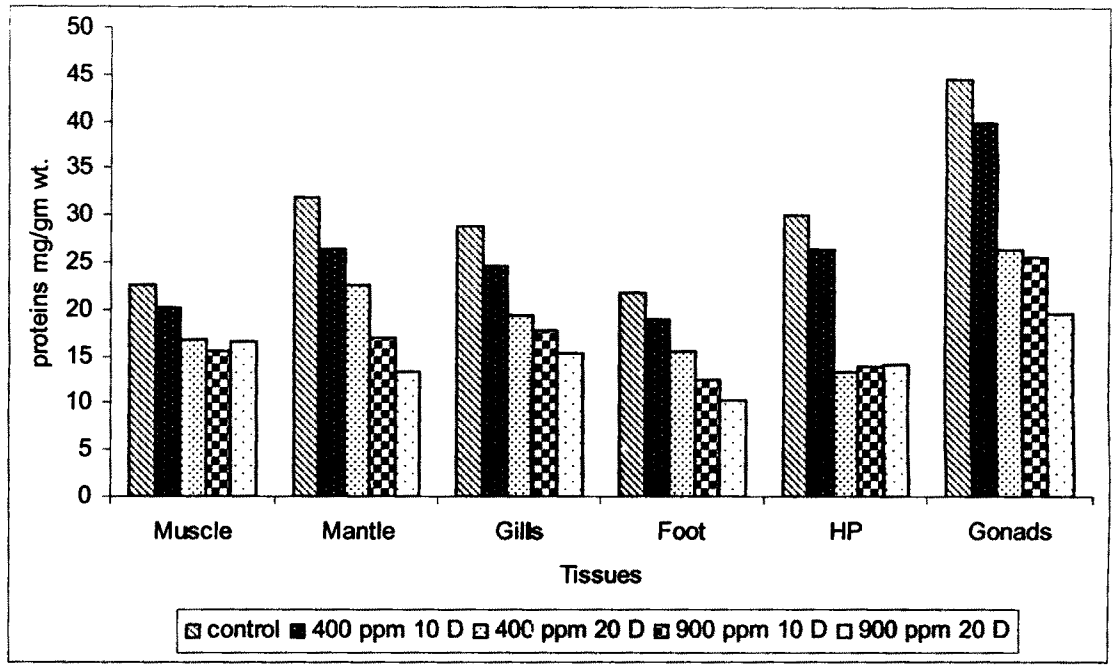
Site	Zn(ppm)		Cr(ppm)	
Sample	Before festival	After festival	Before festival	After festival
Rajghat	0.04 ±0.0009	0.06* ±0.0008	0.002 ±0.0001	0.017* ±0.0008
Sandhyamath	0.04 ±0.0009	0.06* ±0.001	0.0019 ±0.0001	0.008* ±0.0008
Irani Khan	0.83 ±0.002	1.64* ±0.5	0.034 ±0.0009	0.076* ±0.001
Kotiteertha Lake	0.10 ±0.0006	0.43* ±0.002	0.013 ±0.001	0.055* ±0.001
Rajaram Lake	0.17 ±0.001	0.36* ±0.001	BDL	BDL
Panchganga Ghat	0.03 ±0.001	0.074* ±0.0008	BDL	BDL
Rajaram Bandhara	0.05 ±0.001	0.07* ±0.001	BDL	BDL

Values are mean of 4 estimations
*significantly different from before
*P< 0.05 by t-test

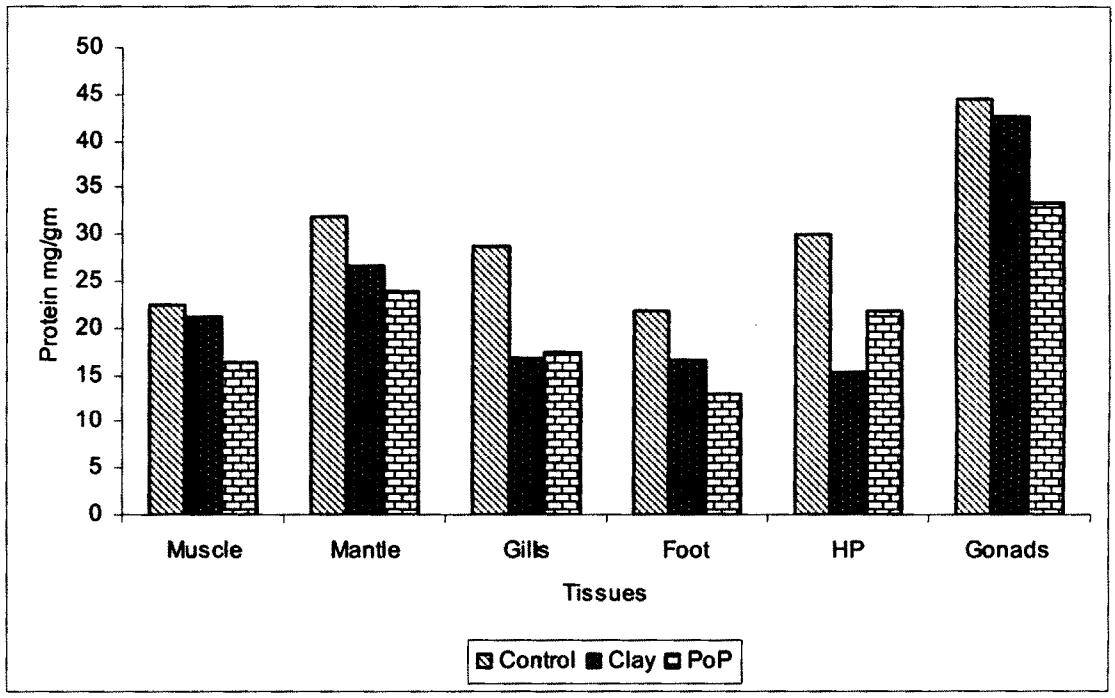
Table 16: Heavy metal accumulation in *Lamellidens marginalis* after exposure to the colour pigments

Metal	Control	400 ppm 10days	400 ppm 20days	900ppm 10days	900 ppm 20days
Copper	0.0002	0.0012*	0.0021*	0.007*	0.0082*
Zinc	0.003	0.044*	0.054*	0.097*	0.09*
Chromium	0.00015	0.0041*	0.0046*	0.054*	0.07*
Lead	0.00015	0.0015*	0.0036*	0.0059*	0.0065*

Values expressed as µg / gm weight.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 21: Protein contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 22: Protein contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 17: Protein contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

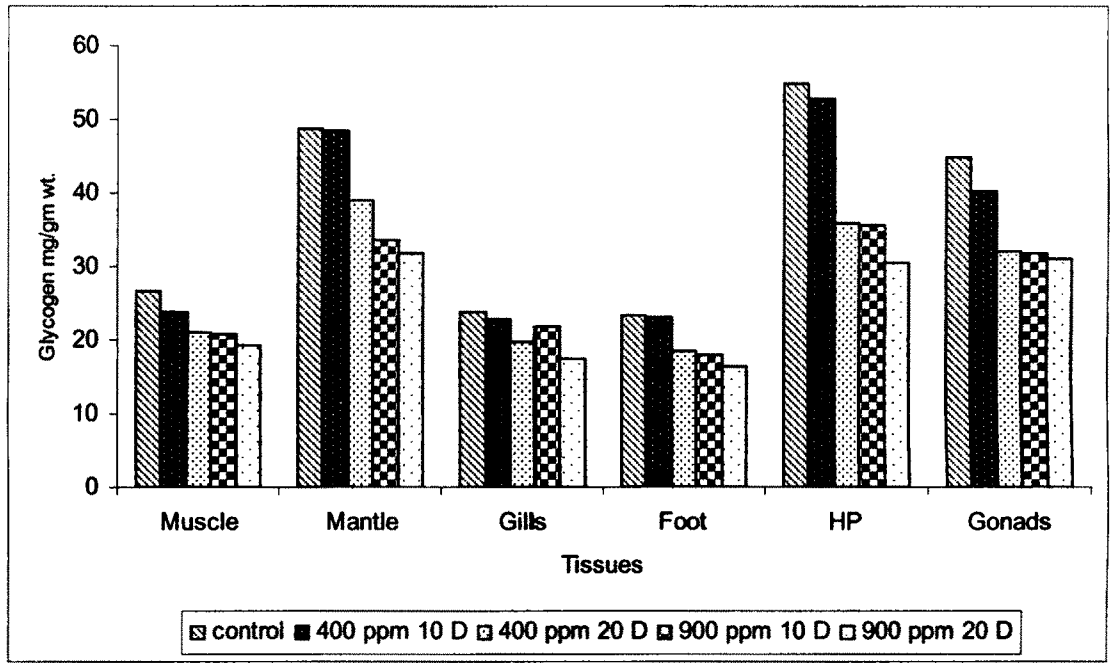
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	22.5 ±1.58	20.25 ±1.9	16.75* ±2.1	15.5* ±1.08	16.62* ±1.8
Mantle	31.87 ±1.7	26.37* ±1.9	22.5* ±2.12	17.0* ±1.2	13.37* ±1.75
Gills	28.75 ±2.3	24.5* ±3.4	19.37* ±3.5	17.75* ±1.5	15.37* ±2.13
Foot	21.75 ±1.8	18.87* ±1.3	15.62* ±1.7	12.5* ±1.2	10.25* ±1.3
HP	30.0 ±1.6	26.37 ±3.7	13.37* ±2.2	13.87* ±1.6	14.12* ±1.6
Gonads	44.5 ±3.3	39.87* ±2.5	26.5* ±2.4	25.62* ±1.7	19.5* ±1.2

Activity expressed as mg / gm weight.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

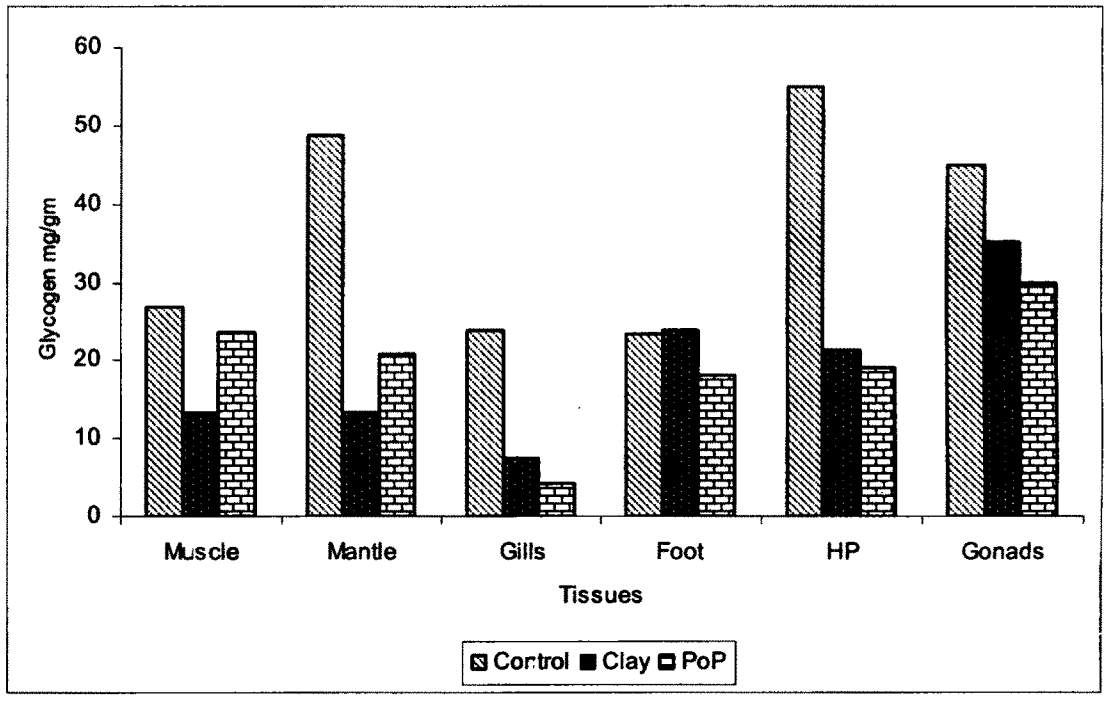
Table 18: Protein contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	22.5 ±1.58	31.87 ±1.7	28.75 ±2.3	21.75 ±1.8	30.0 ±1.6	44.5 ±3.3
PoP	16.37* ±2.56	24.0* ±1.29	17.37* ±3.75	13.12* ±4.28	21.75* ±5.57	33.5* ±0.40
Clay	21.12 ±2.78	26.62* ±2.39	16.81* ±2.23	16.5* ±3.02	15.25* ±0.61	42.62 ±3.88

Activity expressed as mg / gm weight.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 23: Glycogen contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 24: Glycogen contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 19: Glycogen contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

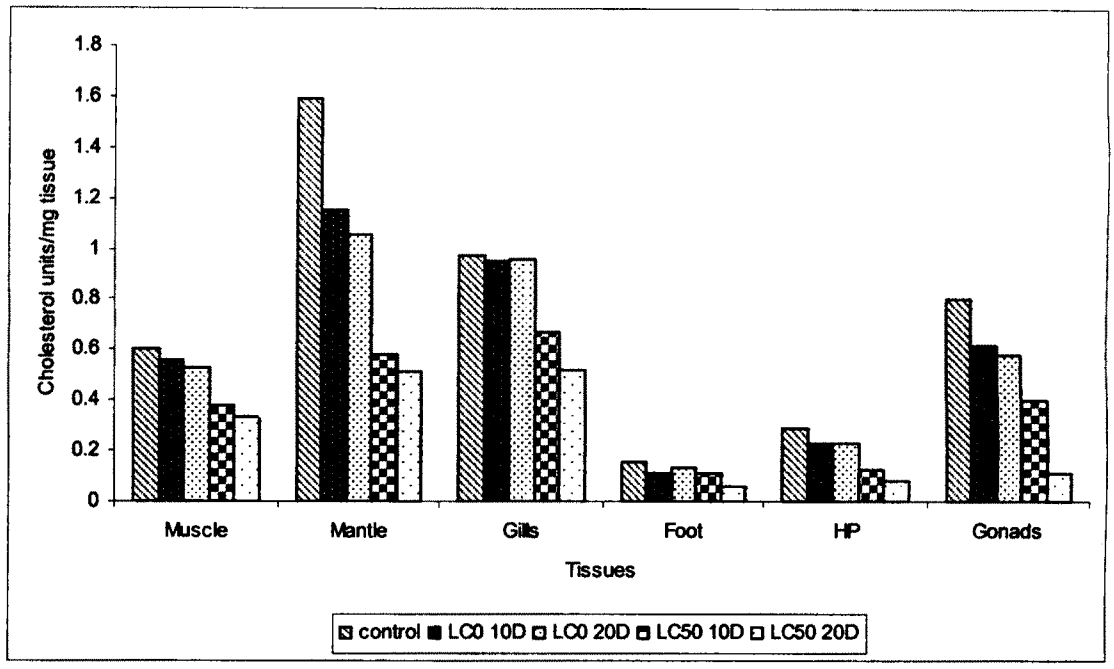
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	26.77 ±2.25	23.81* ±1.9	21.10* ±0.32	20.73* ±0.30	19.17* ±1.4
Mantle	48.79 ±7.98	48.57 ±0.24	38.99* ±1.5	33.66* ±0.47	31.82* ±4.14
Gills	23.95 ±3.11	22.76 ±1.4	19.84* ±1.4	21.73 ±1.39	17.37* ±0.41
Foot	23.33 ±6.07	23.09 ±0.3	18.56 ±1.1	17.90 ±0.70	16.49* ±0.62
HP	54.98 ±17.34	52.72 ±2.2	35.77 ±2.0	35.58 ±3.19	30.57* ±2.44
Gonads	44.95 ±3.65	40.33* ±0.70	32.12* ±2.3	31.78* ±1.86	30.95* ±2.81

Activity expressed as mg / gm weight.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

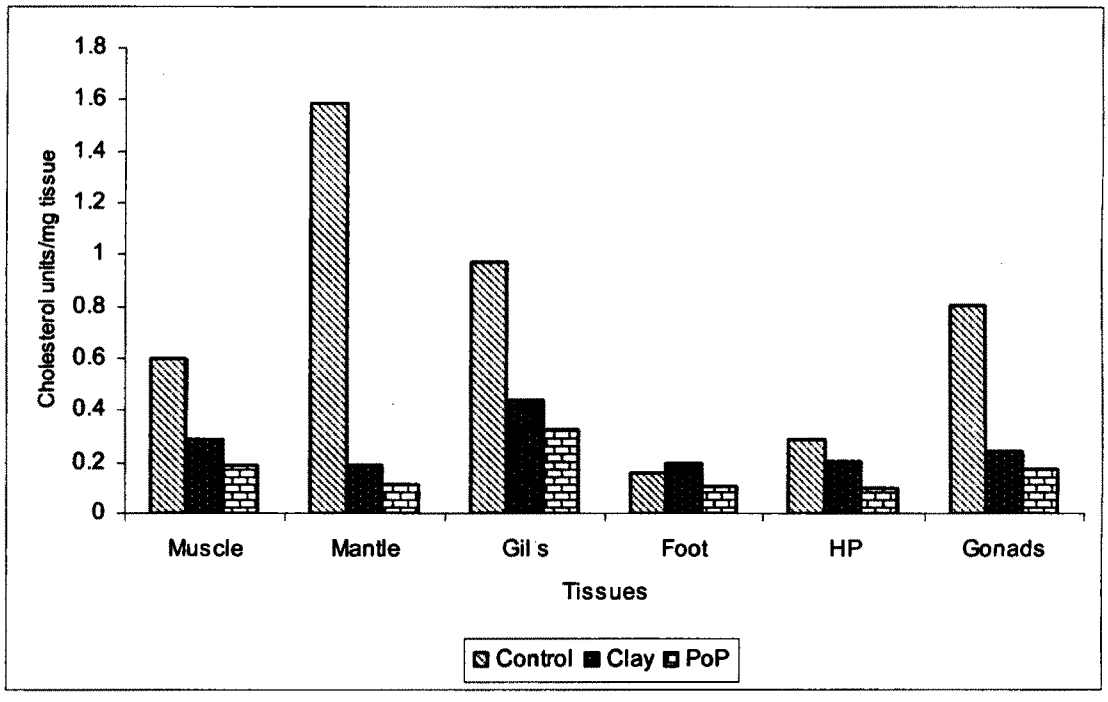
Table 20: Glycogen contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	26.77 ±2.25	48.79 ±7.98	23.95 ±3.11	23.33 ±6.07	54.98 ±17.34	44.95 ±3.65
PoP	23.67 ±3.63	20.88* ±0.91	4.22* ±0.57	18.01 ±1.04	19.13* ±0.52	29.81* ±0.25
Clay	13.33* ±2.19	13.36* ±1.26	7.42* ±2.51	23.91 ±1.19	21.24* ±1.28	35.19* ±0.40

Activity expressed as mg / gm weight.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 25: Cholesterol contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 26: Cholesterol contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 21: Cholesterol contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

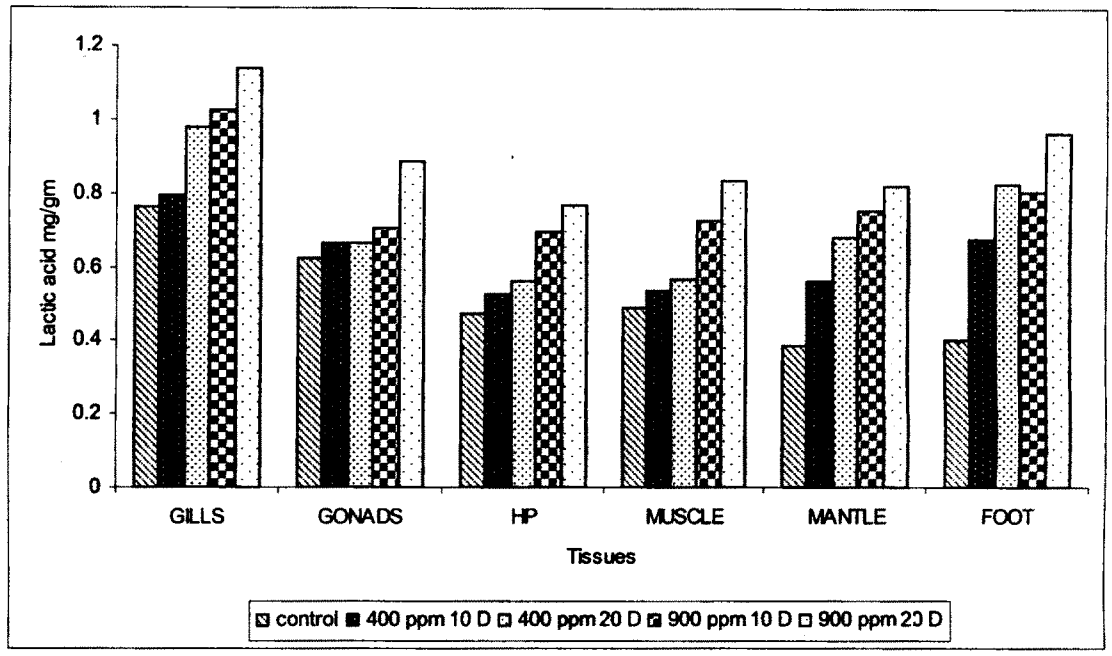
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	0.59 ±0.04	0.55 ±0.02	0.52* ±0.04	0.38* ±0.04	0.33* ±0.03
Mantle	1.58 ±0.23	1.15* ±0.1	1.05* ±0.07	0.58* ±0.07	0.50* ±0.07
Gills	0.97 ±0.06	0.95 ±0.02	0.95 ±0.07	0.66* ±0.10	0.52* ±0.02
Foot	0.15 ±0.04	0.11 ±0.05	0.13 ±0.02	0.10 ±0.03	0.06* ±0.02
HP	0.28 ±0.11	0.22 ±0.04	0.23 ±0.07	0.12* ±0.05	0.08* ±0.01
Gonads	0.80 ±0.41	0.61 ±0.04	0.58 ±0.03	0.39 ±0.05	0.10* ±0.03

Activity expressed as units / mg tissue.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

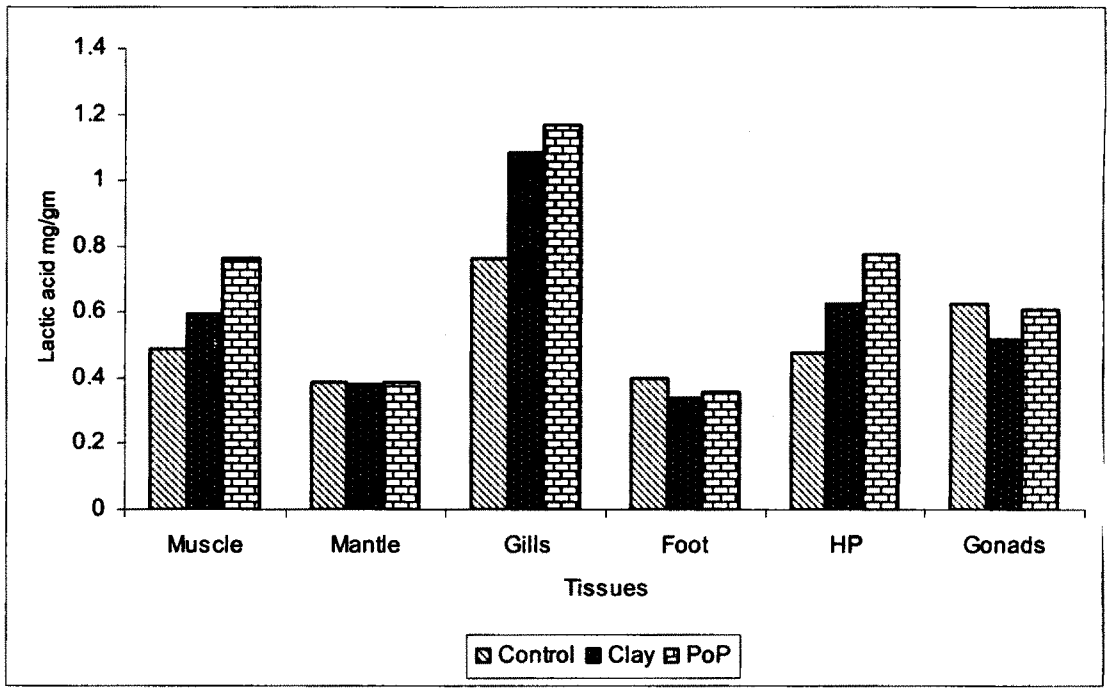
Table 22: Cholesterol contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	0.59 ±0.04	1.58 ±0.23	0.97 ±0.06	0.15 ±0.04	0.28 ±0.11	0.80 ±0.41
PoP	0.18* ±0.003	0.11* ±0.011	0.32* ±0.01	0.106 ±0.01	0.096* ±0.04	0.175* ±0.01
Clay	0.29* ±0.007	0.18* ±0.01	0.43* ±0.01	0.19 ±0.03	0.20 ±0.006	0.24* ±0.01

Activity expressed as units / mg tissue.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 27: Lactic acid contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 28: Lactic acid contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 23: Lactic acid contents of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

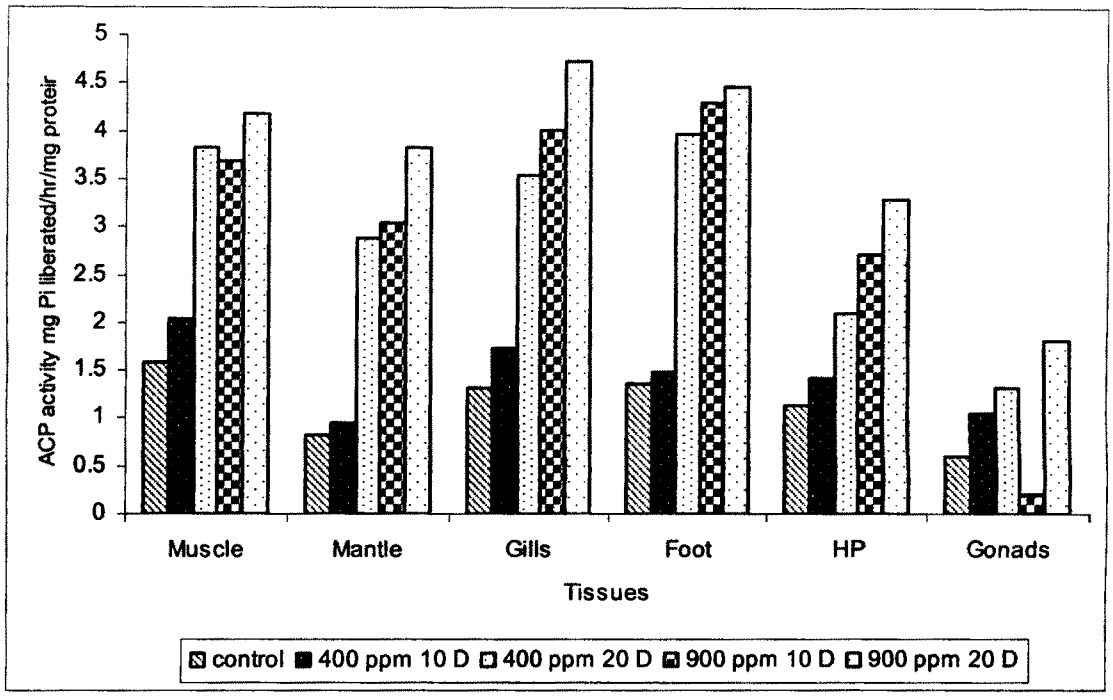
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	0.48 ±0.02	0.53 ±0.04	0.56* ±0.007	0.72* ±0.04	0.83* ±0.003
Mantle	0.38 ±0.01	0.56* ±0.04	0.67* ±0.04	0.75* ±0.04	0.81* ±0.01
Gills	0.75 ±0.23	0.79 ±0.03	0.97 ±0.07	1.026 ±0.02	1.13* ±0.07
Foot	0.40 ±0.05	0.67* ±0.19	0.82* ±0.02	0.80* ±0.018	0.96* ±0.005
HP	0.47 ±0.02	0.52* ±0.03	0.56* ±0.03	0.69* ±0.008	0.76* ±0.008
Gonads	0.62 ±0.16	0.66 ±0.05	0.66 ±0.03	0.705 ±0.05	0.88* ±0.06

Activity expressed as mg/gm weight.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

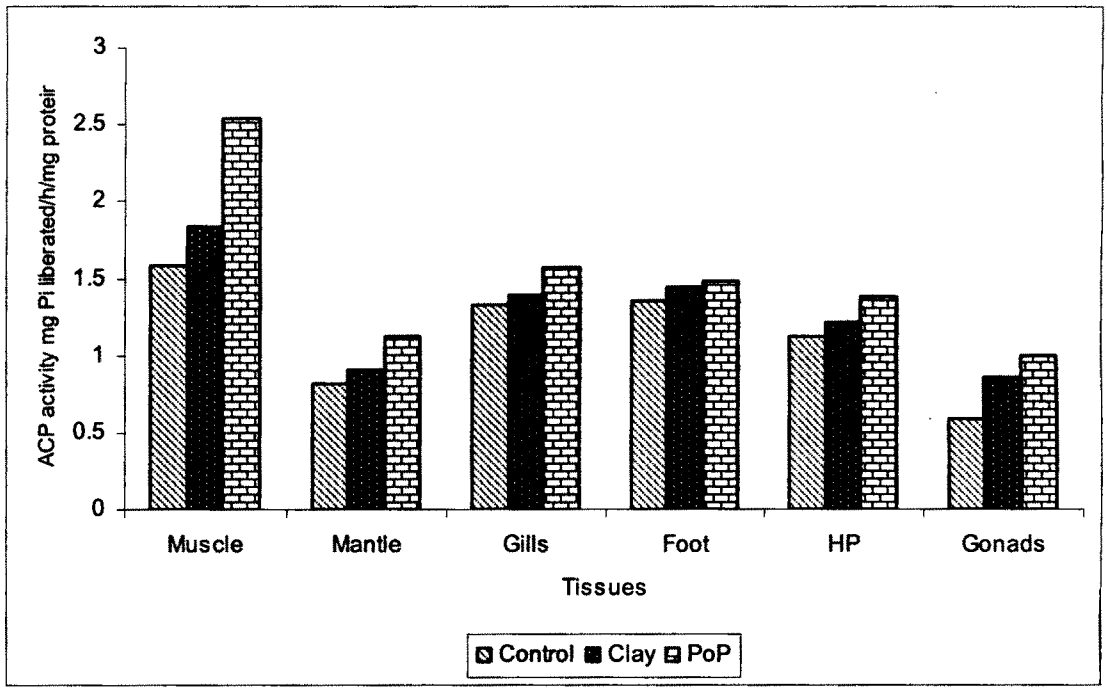
Table 24: Lactic acid contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	0.48 ±0.02	0.38 ±0.01	0.75 ±0.23	0.40 ±0.05	0.47 ±0.02	0.62 ±0.16
PoP	0.76* ±0.03	0.38 ±0.004	1.16* ±0.006	0.35 ±0.004	0.77* ±0.01	0.60 ±0.04
Clay	0.59* ±0.03	0.38 ±0.01	1.08* ±0.01	0.34 ±0.03	0.62* ±0.009	0.51 ±0.06

Activity expressed as mg/gm weight.
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 29: ACP activity in the freshwater bivalve, *Lamellidens marginalis* exposed t colour pigments



Graph 30: ACP activity in freshwater bivalve, *Lamellidens marginalis* exposed to Po and clay idol

Table 25: Acid phosphatase activity of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

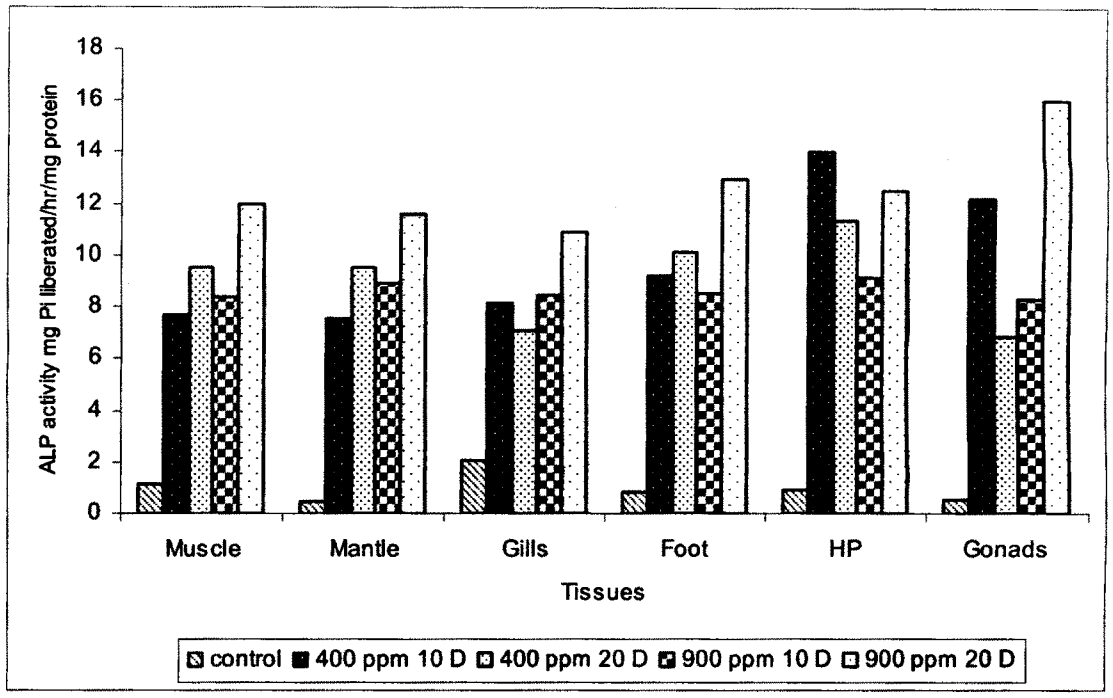
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	1.58 ±0.28	2.03* ±0.14	3.82* ±0.38	3.67* ±0.39	4.17* ±0.99
Mantle	0.82 ±0.09	0.94 ±0.15	2.87* ±0.59	3.03* ±0.55	3.82* ±0.27
Gills	1.32 ±0.37	1.73 ±0.28	3.53* ±0.72	4.01* ±0.28	4.73* ±0.25
Foot	1.35 ±0.27	1.48 ±0.48	3.96* ±0.76	4.30* ±0.25	4.46* ±0.43
HP	1.12 ±0.29	1.42 ±0.52	2.08* ±0.19	2.71* ±0.18	3.28* ±0.30
Gonads	0.58 ±0.06	1.05* ±0.36	1.32* ±0.14	0.21* ±0.02	1.80* ±0.17

Activity expressed as mg Pi liberated/h/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

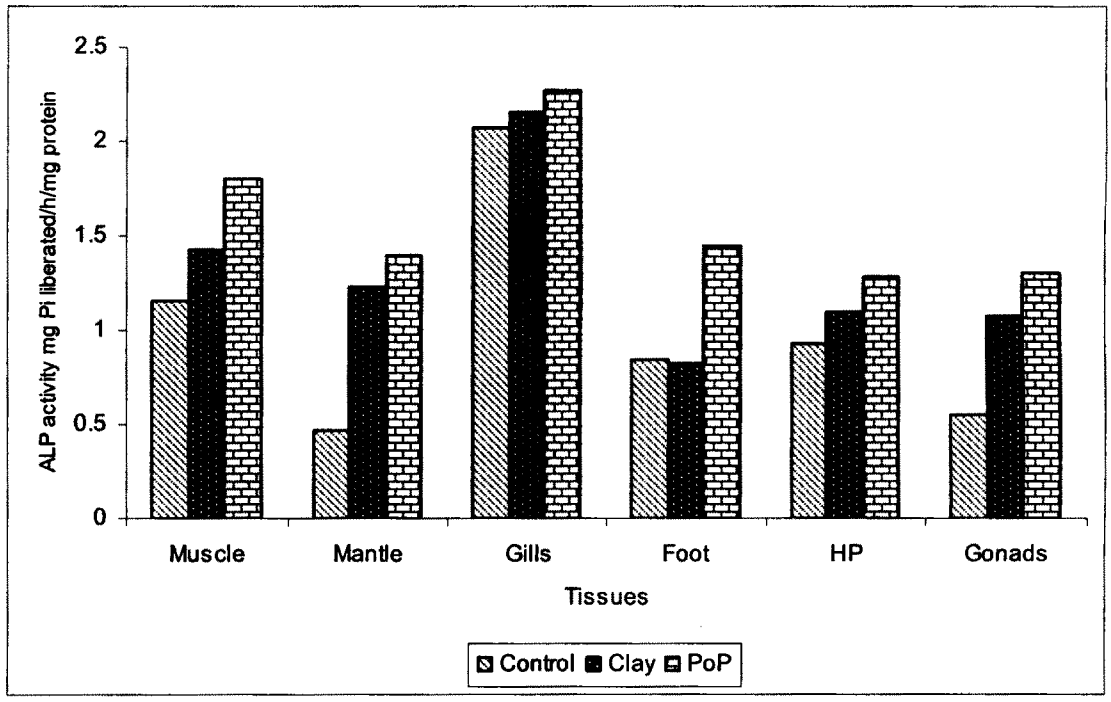
Table 26: ACP activity in the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	1.58 ±0.28	0.82 ±0.09	1.32 ±0.37	1.35 ±0.27	1.12 ±0.29	0.58 ±0.06
PoP	2.53* ±0.26	1.12* ±0.08	1.57 ±0.2	1.48 ±0.14	1.37 ±0.12	1.0* ±0.2
Clay	1.83 ±0.2	0.91 ±0.19	1.39 ±0.09	1.44 ±0.15	1.21 ±0.13	0.85* ±0.11

Activity expressed as mg Pi liberated/h/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 31: ALP activity in the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 32: ALP activity in freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 27: Alkaline phosphatase activity of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

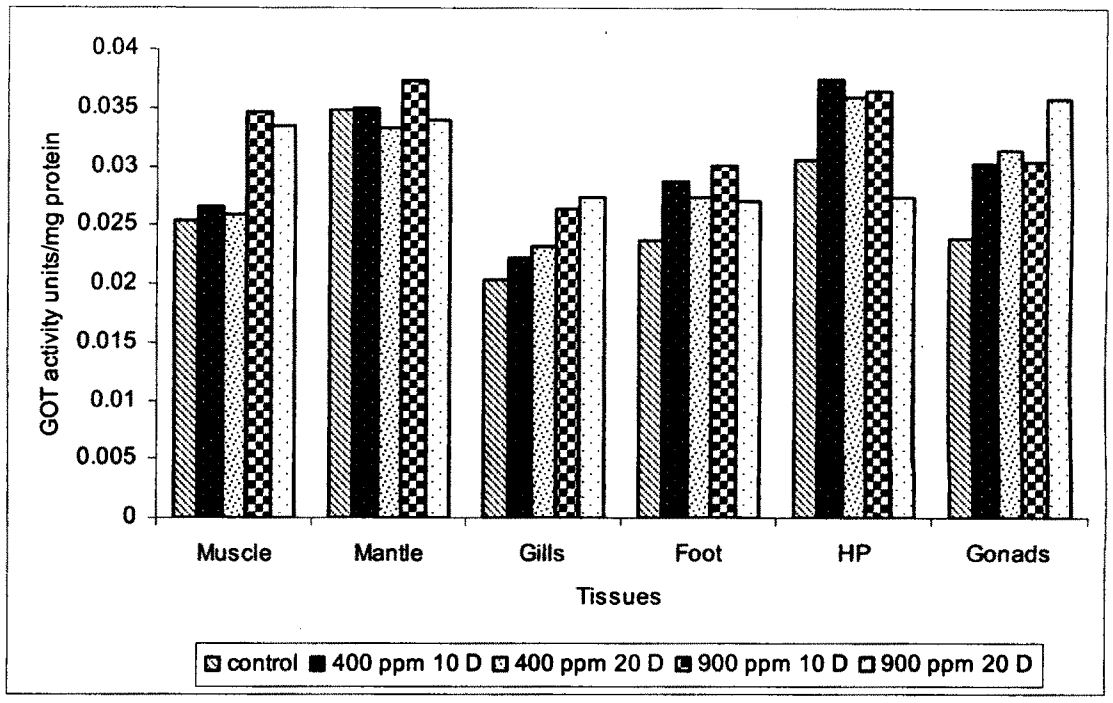
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	1.16 ±0.30	7.73* ±0.77	9.5* ±0.59	8.35* ±0.63	12.0* ±0.81
Mantle	0.46 ±0.25	7.57* ±1.10	9.5* ±0.93	8.94* ±0.37	11.58* ±0.56
Gills	2.07 ±0.53	8.17* ±0.82	7.12* ±1.62	8.44* ±0.39	10.89* ±1.07
Foot	0.83 ±0.51	9.23* ±0.56	10.12* ±1.57	8.53* ±0.87	12.96* ±0.94
HP	0.92 ±0.30	14.01* ±0.47	11.33* ±0.54	9.12* ±0.57	12.51* ±0.85
Gonads	0.55 ±0.34	12.21* ±0.90	6.89* ±0.74	8.30* ±1.59	16.01* ±0.98

Activity expressed as mg Pi liberated/h/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

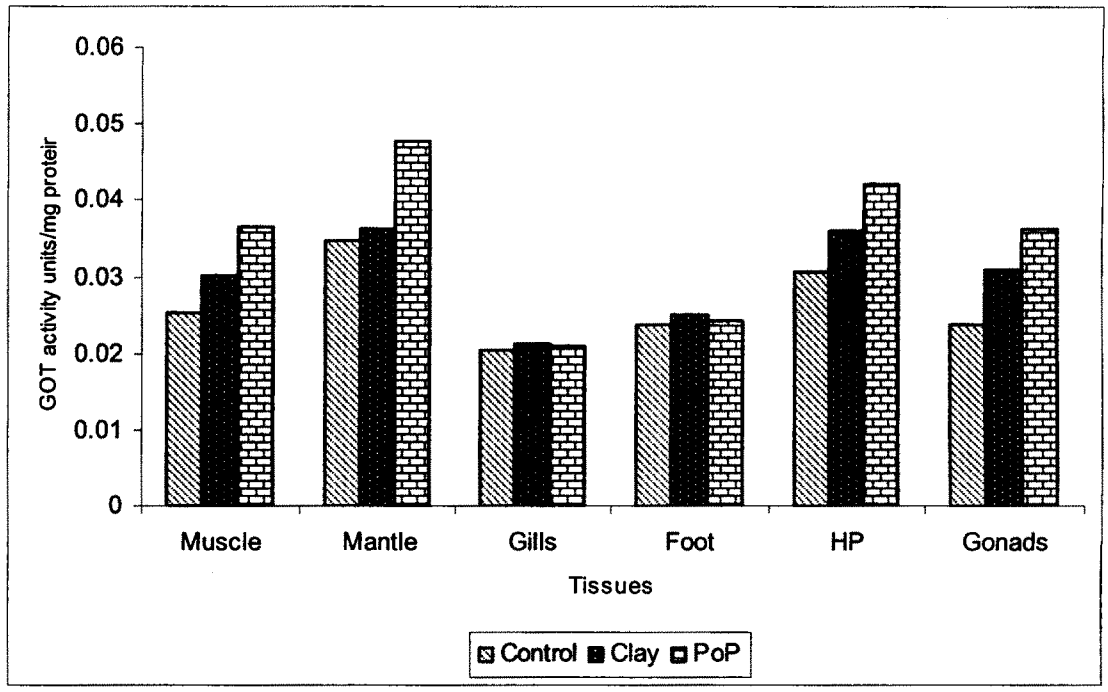
Table 28: ALP activity in the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	1.16 ±0.30	0.46 ±0.25	2.07 ±0.53	0.83 ±0.51	0.92 ±0.30	0.55 ±0.34
PoP	1.80* ±0.035	1.39* ±0.31	2.26 ±0.12	1.44 ±0.08	1.28* ±0.05	1.30* ±0.26
Clay	1.42 ±0.05	1.23* ±0.08	2.16 ±0.14	0.82 ±0.13	1.08 ±0.13	1.07* ±0.17

Activity expressed as mg Pi liberated/h/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 33: GOT activity in the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 34: GOT activity in freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 29: GOT activity of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

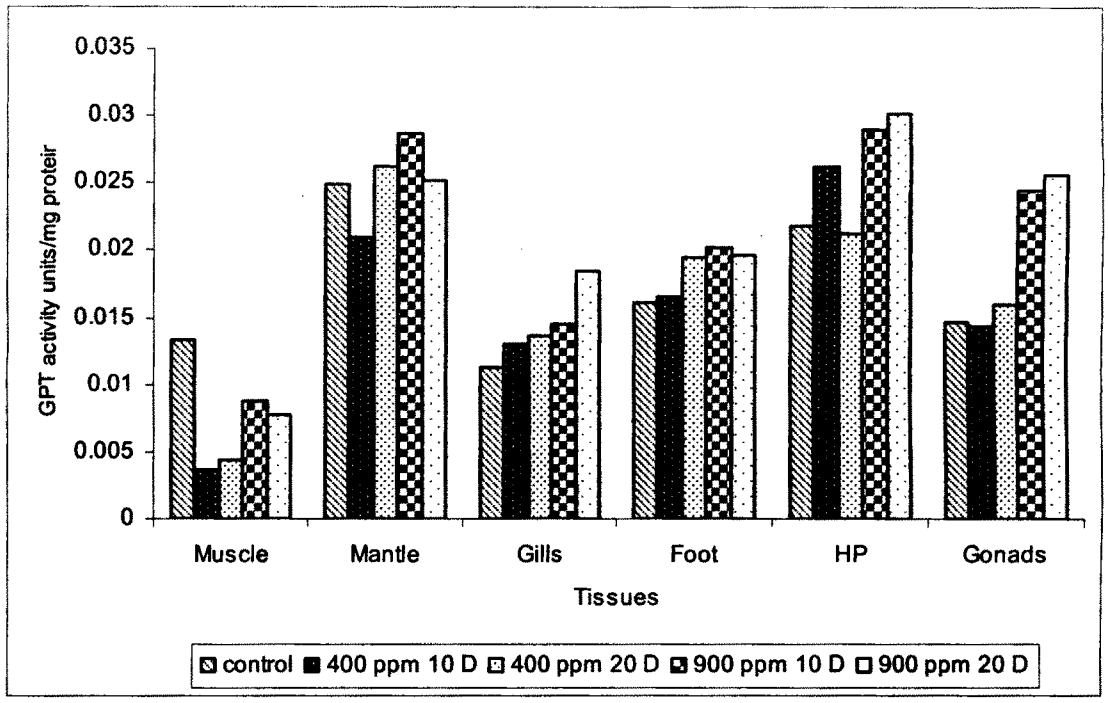
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	0.025 ±0.009	0.026 ±0.005	0.025 ±0.004	0.034 ±0.006	0.033 ±0.005
Mantle	0.034 ±0.005	0.035 ±0.010	0.033 ±0.008	0.037 ±0.005	0.034 ±0.009
Gills	0.020 ±0.006	0.022 ±0.006	0.023 ±0.003	0.026 ±0.002	0.027 ±0.007
Foot	0.023 ±0.009	0.028 ±0.005	0.027 ±0.008	0.030 ±0.005	0.027 ±0.007
HP	0.030 ±0.005	0.037 ±0.014	0.036 ±0.010	0.036 ±0.006	0.027 ±0.007
Gonads	0.023 ±0.009	0.030 ±0.002	0.031 ±0.005	0.030 ±0.002	0.035* ±0.007

Activity expressed as units/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

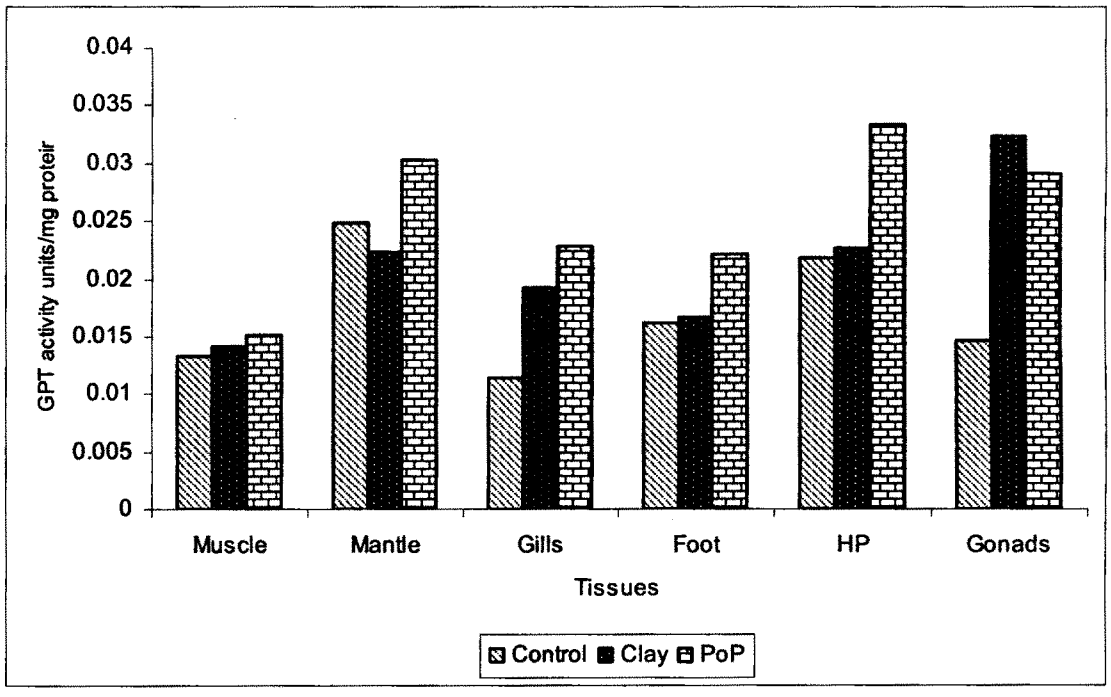
Table 30: GOTactivity in the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	0.025 ±0.009	0.034 ±0.005	0.020 ±0.006	0.023 ±0.009	0.030 ±0.005	0.023 ±0.009
PoP	0.036* ±0.001	0.047* ±0.001	0.020 ±0.001	0.024 ±0.002	0.042* ±0.001	0.036* ±0.001
Clay	0.030 ±0.001	0.036 ±0.002	0.021 ±0.001	0.025 ±0.004	0.036 ±0.001	0.031 ±0.002

Activity expressed as units/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 35: GPT activity in the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 36: GPT activity in freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 31: GPT activity of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

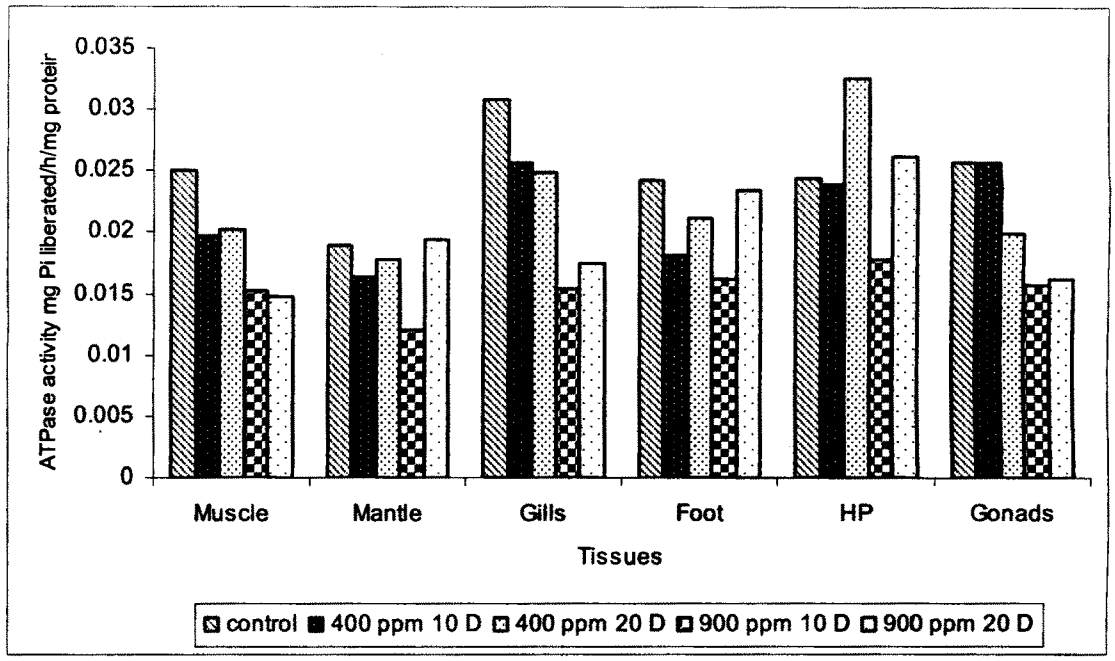
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	0.013 ±0.008	0.003 ±0.002	0.004 ±0.002	0.008 ±0.002	0.007 ±0.002
Mantle	0.024 ±0.016	0.021 ±0.005	0.026 ±0.003	0.028 ±0.002	0.025 ±0.004
Gills	0.011 ±0.006	0.013 ±0.002	0.013 ±0.002	0.014 ±0.008	0.018* ±0.003
Foot	0.016 ±0.010	0.016 ±0.001	0.019 ±0.0008	0.020 ±0.003	0.019 ±0.006
HP	0.021 ±0.008	0.026 ±0.003	0.021 ±0.004	0.029 ±0.004	0.030 ±0.003
Gonads	0.014 ±0.004	0.014 ±0.002	0.016 ±0.003	0.024* ±0.002	0.025* ±0.009

Activity expressed as units/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

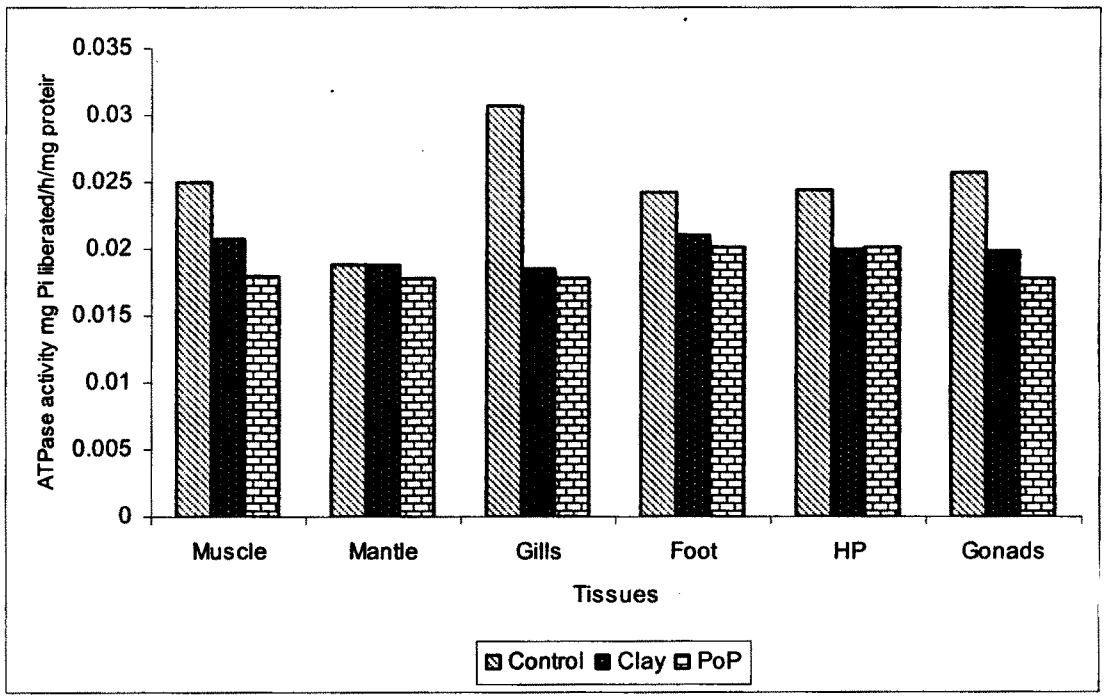
Table 32: GPT activity in Glycogen contents of the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	0.013 ±0.008	0.024 ±0.01	0.011 ±0.006	0.016 ±0.01	0.021 ±0.008	0.014 ±0.004
PoP	0.015 ±0.001	0.030 ±0.0008	0.022* ±0.004	0.022 ±0.001	0.033* ±0.001	0.029* ±0.002
Clay	0.014 ±0.001	0.022 ±0.0008	0.019 ±0.005	0.016 ±0.001	0.022 ±0.002	0.032* ±0.004

Activity expressed as units/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 37: ATPase activity in the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 38: ATPase activity in freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol

Table 33: ATPase activity of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

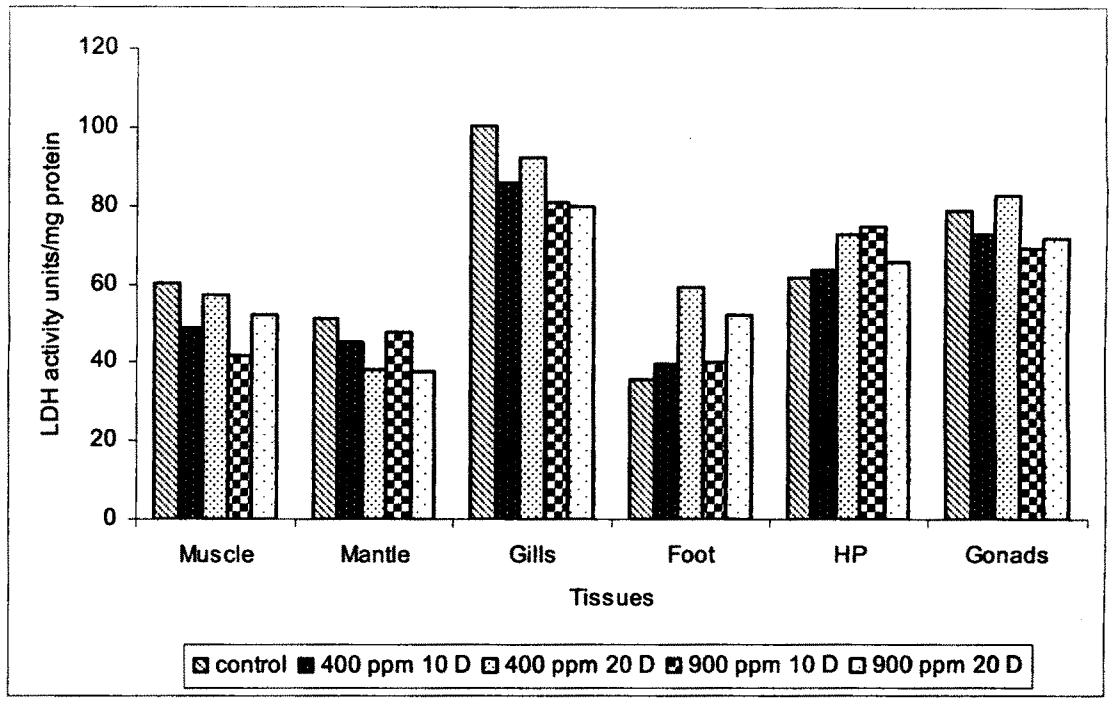
Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	0.024 ±0.002	0.019 ±0.006	0.020 ±0.009	0.015* ±0.006	0.014* ±0.002
Mantle	0.018 ±0.001	0.016 ±0.002	0.017 ±0.003	0.012* ±0.003	0.019 ±0.002
Gills	0.030 ±0.002	0.025 ±0.005	0.024* ±0.004	0.015* ±0.004	0.017* ±0.001
Foot	0.024 ±0.002	0.018* ±0.003	0.021 ±0.006	0.016* ±0.003	0.023 ±0.012
HP	0.024 ±0.001	0.023 ±0.001	0.032* ±0.003	0.017 ±0.006	0.026 ±0.003
Gonads	0.025 ±0.007	0.025 ±0.005	0.019 ±0.005	0.015* ±0.003	0.016* ±0.003

Activity expressed as mg Pi liberated/h/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

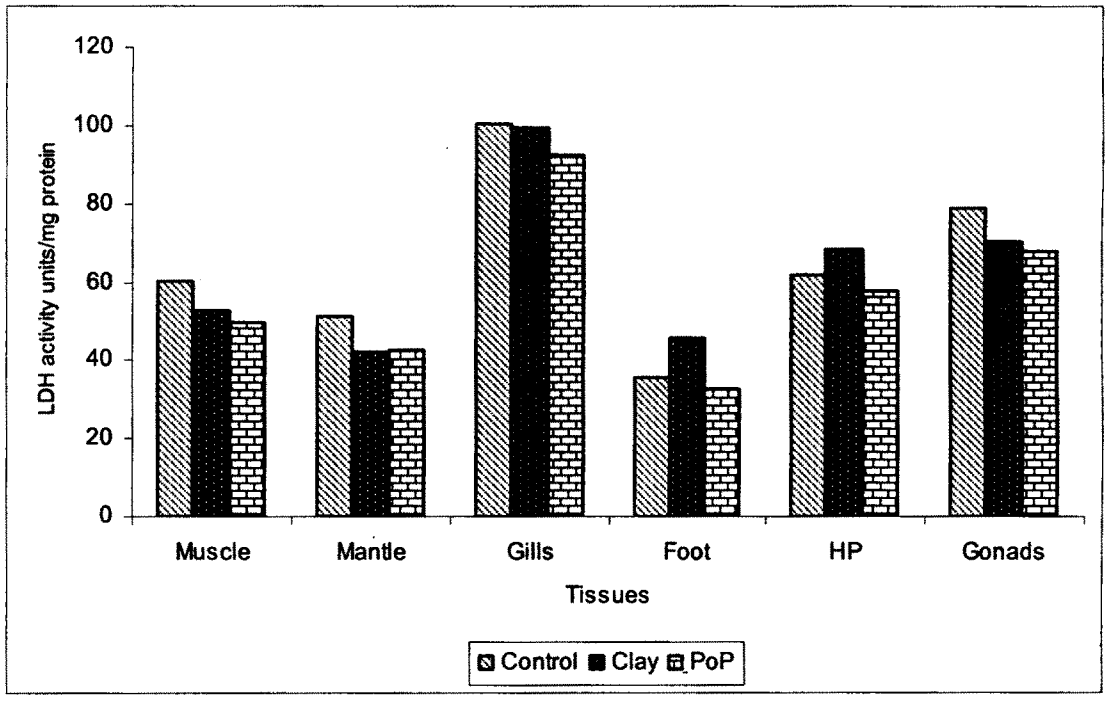
Table 34: ATPase activity in the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	0.024 ±0.002	0.018 ±0.001	0.030 ±0.002	0.024 ±0.002	0.024 ±0.001	0.025 ±0.007
PoP	0.018* ±0.0007	0.017 ±0.001	0.017* ±0.001	0.020* ±0.0002	0.020* ±0.0007	0.017 ±0.0001
Clay	0.020* ±0.0002	0.018 ±0.001	0.018* ±0.001	0.021* ±0.0002	0.020* ±0.001	0.019 ±0.001

Activity expressed as mg Pi liberated/h/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test



Graph 39: LDH activity in the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments



Graph 40: LDH activity in freshwater bivalve, *Lamellidens marginalis* exposed to Pol and clay idol

Table 35: LDH activity of the freshwater bivalve, *Lamellidens marginalis* exposed to colour pigments

Tissue	Control	400 ppm 10days	400 ppm 20days	900 ppm 10days	900 ppm 20days
Muscle	60.3 ±7.09	48.6* ±3.73	57.0 ±5.58	41.7* ±6.30	52.2 ±7.49
Mantle	51.3 ±8.44	45.0 ±8.16	38.1* ±8.61	47.7 ±2.04	37.5* ±6.88
Gills	100.2 ±6.96	85.8* ±7.92	92.4 ±5.09	81.0* ±9.42	79.8* ±4.43
Foot	35.7 ±6.67	39.6 ±2.59	59.4* ±8.56	40.2 ±8.56	52.2* ±4.43
HP	61.8 ±6.96	63.6 ±2.59	72.9* ±5.74	74.7* ±6.37	66.0 ±6.42
Gonads	78.9 ±6.67	72.9 ±2.27	82.8 ±3.79	69.3* ±2.66	72.0 ±11.51

Activity expressed as units/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

Table 36: LDH activity in the freshwater bivalve, *Lamellidens marginalis* exposed to PoP and clay idol water

	Muscle	Mantle	Gills	Foot	HP	Gonads
Control	60.3 ±7.09	51.3 ±8.44	100.2 ±6.96	35.7 ±6.67	61.8 ±6.96	78.9 ±6.67
PoP	49.8* ±6.0	42.6 ±6.6	92.4 ±5.09	32.4 ±4.27	57.9 ±3.58	67.8* ±4.43
Clay	52.5 ±6.2	42.3 ±3.3	99.3 ±3.96	45.9 ±10.38	68.4 ±3.09	70.2* ±3.6

Activity expressed as units/mg protein
Values are mean ± S.D. of 4 estimations.
* Significantly different from control.
*P< 0.05 by t-test

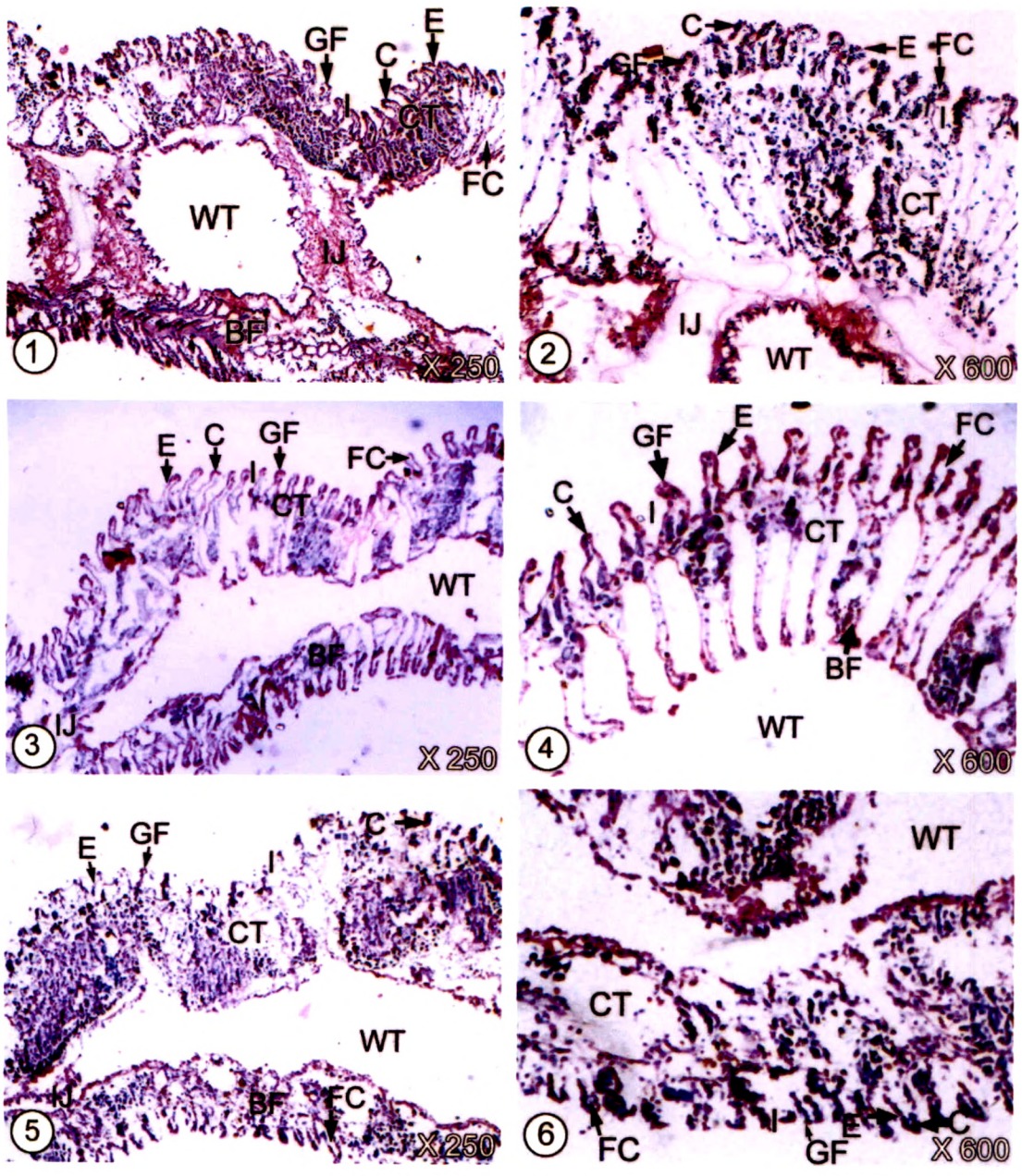


Fig 1,2: Light microphotograph of gills of control bivalve, *Lamellidens marginalis* showing gill filaments (GF), Epithelial cells (E), Cilia (C), Connective tissue (CT), Basal filament (BF), Filament cavity (FC), Interfilament cavity (I), Interlamellar junction (IJ) and water tubes (WT)

Fig 3,4: Light microphotograph of gills of bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments for 10 days showing elongated gill filament (GF), epithelial cells (E), Cilia (C), increased vacuolation in the connective tissue (CT), increase in filament cavity (FC) and Interfilament cavity (I). Note elongated water tubes(WT) and interlamellar junction (IJ).

Fig. 5,6: Light microphotograph of gills of bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments for 20 days showing, gill filament (GF), epithelial cells (E), with dark material, cilia (C), vacuolation in connective tissue (CT), increased filament cavity (FC) and interfilament cavity (I). Note elongated water tubes (WT) with interlamellar junctions (IJ).

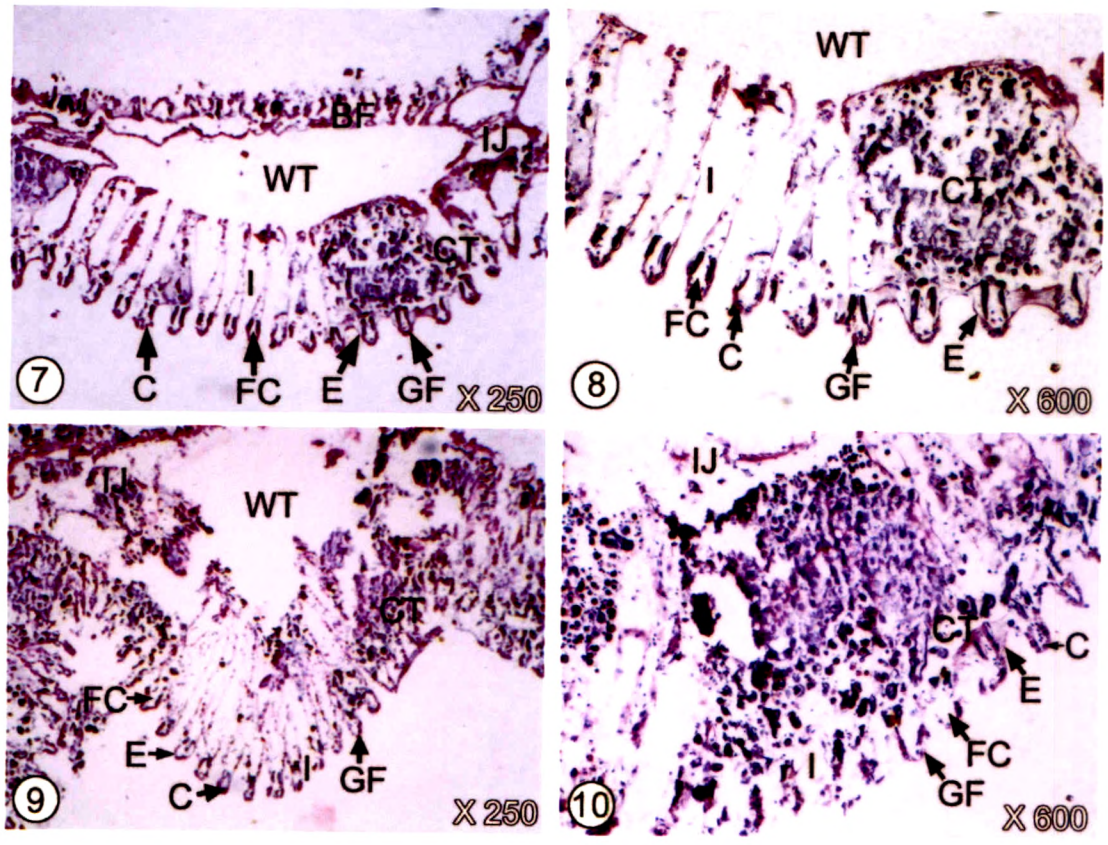


Fig. 7,8: : Light microphotograph of gills of bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments for 10 days showing, gill filaments (GF), epithelial cells (E), cilia (C), vacuolated connective tissue (CT), increased filament cavity (FC) and interlamellar space (I). Note increase in water tubes (WT) and short lamellar junctions (IJ).

Fig. 9, 10: Light microphotograph of gills of bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments for 20 days showing, gill filaments (GF) with epithelial cells (E) with dark material, cilia (C), vacuolation in connective tissue (CT), increased interfilament cavity (I) and filament cavity (FC). Note wide water tubes (WT) with short interlamellar junctions (IJ).

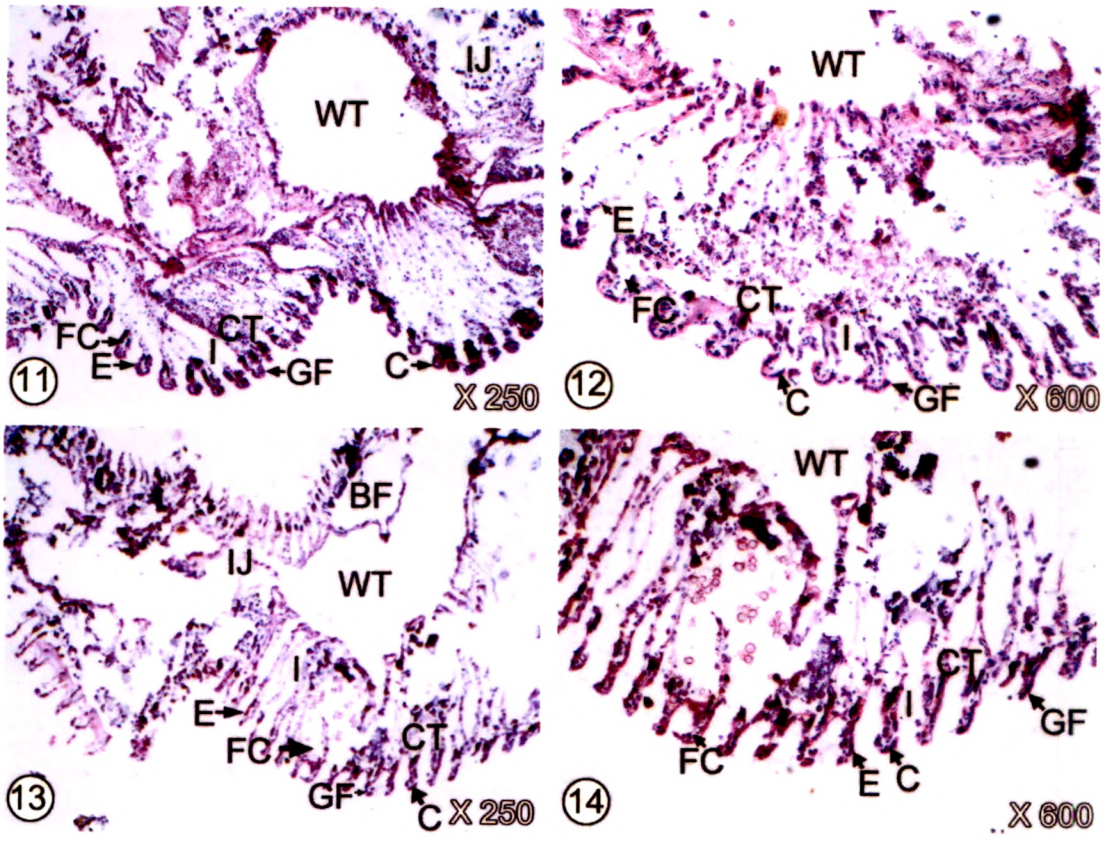


Fig. 11,12: Light microphotograph of gills of bivalve, *Lamellidens marginalis* exposed to clay idol for 15 days showing, gill filaments (GF) with epithelial cells (E) with accumulation of clay particals, cilia (C), Connective tissue (CT), Basal filament (BF), Filament cavity (FC), Interfilament cavity (I), Interlamellar junction (IJ) and water tubes (WT)

Fig. 13,14: Light microphotograph of gills of bivalve, *Lamellidens marginalis* exposed to PoP idol for 15 days showing, elongated gill filaments (GF), epithelial cells (E), cilia (C), vacuolation in connective tissue (CT), increased interfilament space (I) and filament cavity (FC). Note wide irregularly shaped water tubes (WT) with short interlamellar junctions (IJ).

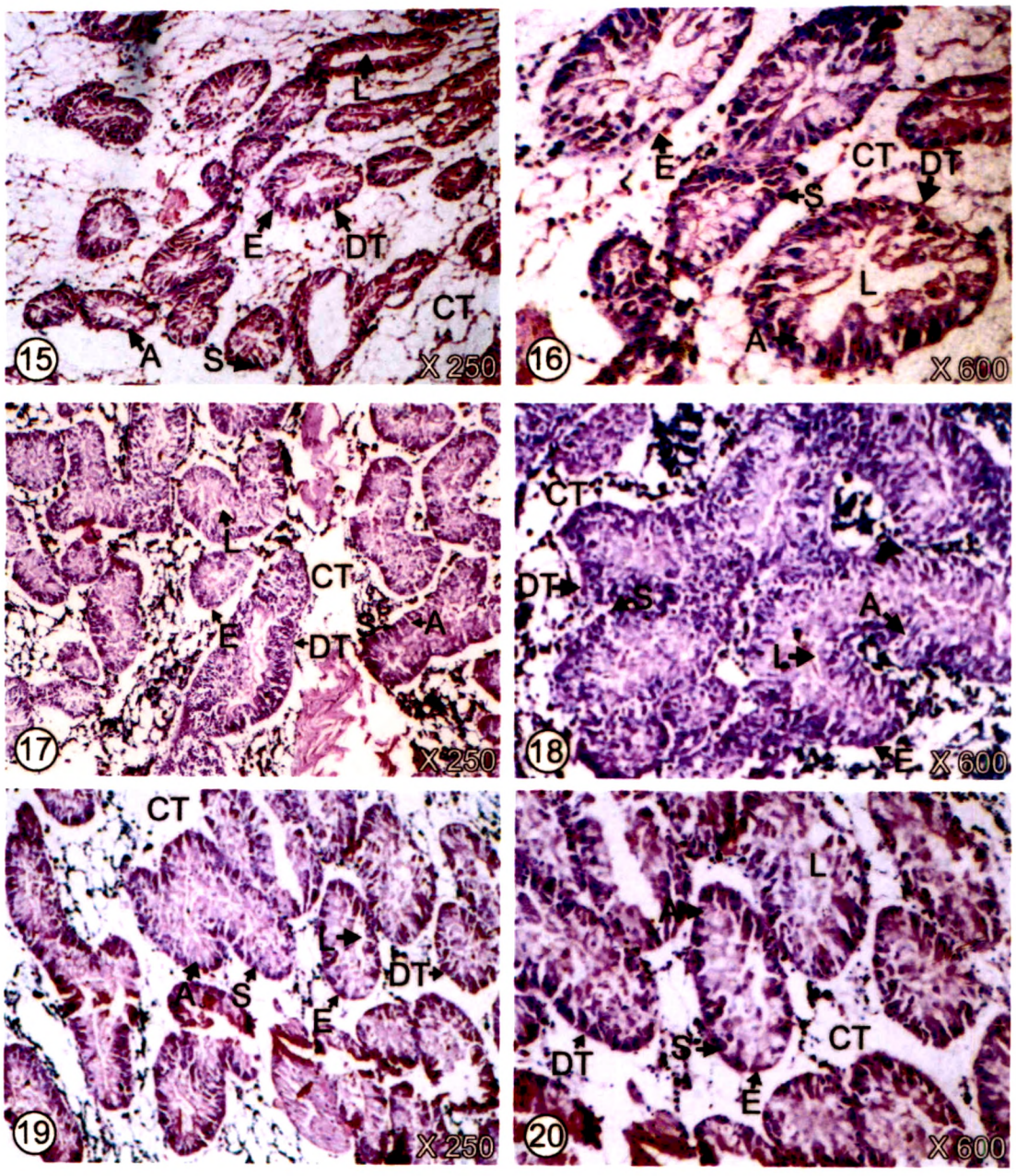


Fig. 15,16: Light microphotograph of hepatopancreas of control bivalve, *Lamellidens marginalis* showing, Digestive tubule (DT), epithelium (E), columnar or absorptive cells (A), secretory cells (S), connective tissue (CT) and Lumen (L).

Fig. 17,18: Light microphotograph of hepatopancreas of bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments for 10 days showing, digestive tubules (DT) with epithelium (E) and absorptive cells (A) and secretory cells (S), vacuolated connective tissue (CT) and decreased lumen (L).

Fig. 19,20: Light microphotograph of hepatopancreas of bivalve, *Lamellidens marginalis* exposed to 400 ppm colour pigments for 20 days showing, digestive tubules (DT) with epithelium (E) and absorptive cells (A) and secretory cells (S), vacuolated connective tissue (CT) and decreased lumen (L).

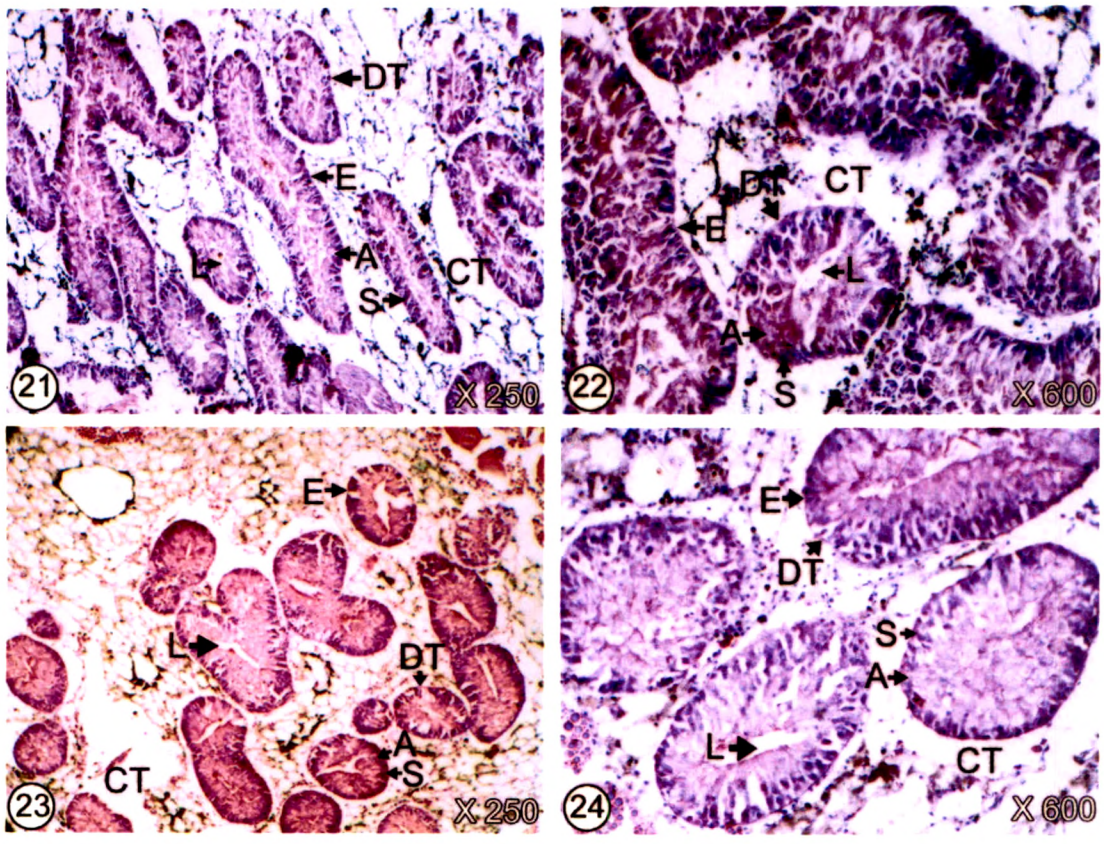


Fig. 21,22: Light microphotograph of hepatopancreas of bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments for 10 days showing, digestive tubules (DT) with epithelium (E) and absorptive cells (A) and secretory cells (S), vacuolated connective tissue (CT) and decreased lumen (L).

Fig. 23,24: Light microphotograph of hepatopancreas of bivalve, *Lamellidens marginalis* exposed to 900 ppm colour pigments for 20 days showing, digestive tubules (DT) with epithelium (E) and absorptive cells (A) and secretory cells (S), disintegrated vacuolated connective tissue (CT) and decreased lumen (L).

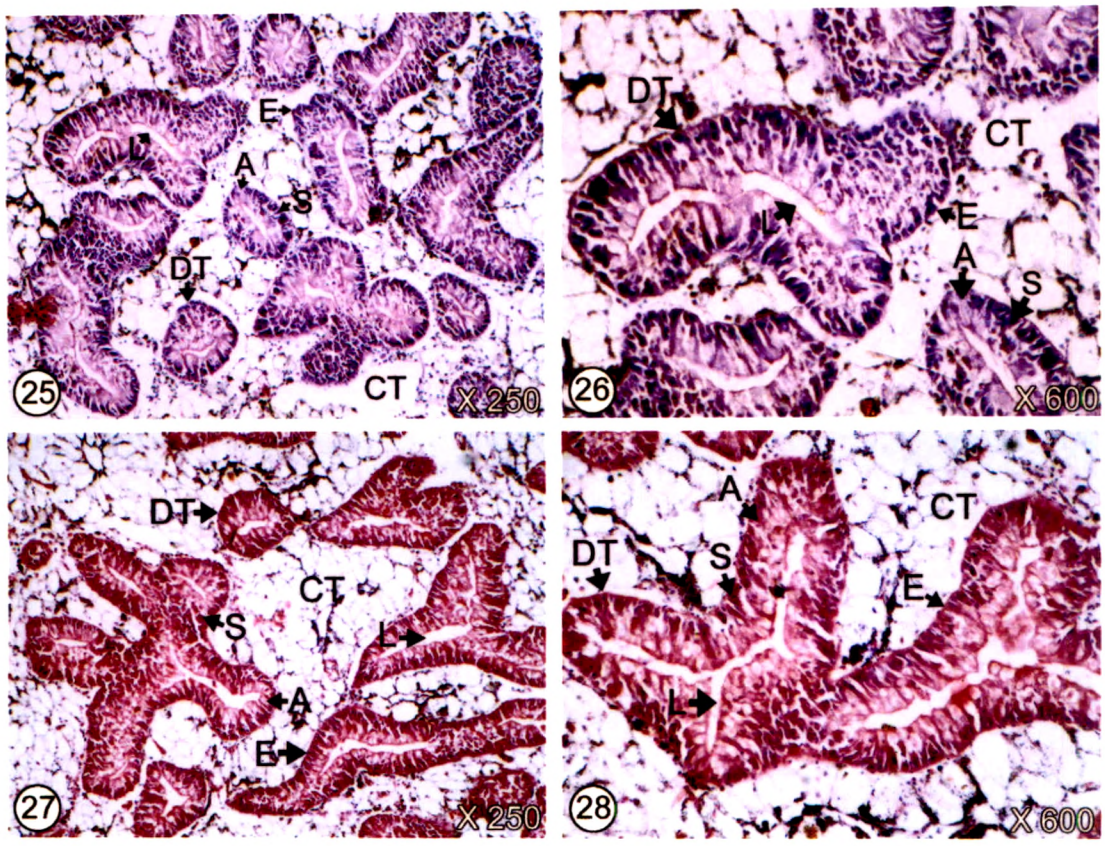


Fig. 25,26: Light microphotograph of hepatopancreas of bivalve, *Lamellidens marginalis* exposed to clay idol for 15 days showing, digestive tubules (DT) with epithelium (E) and absorptive cells (A) and secretory cells (S), disintegrated vacuolated connective tissue (CT) and decreased lumen (L).

Fig. 27,28: Light microphotograph of hepatopancreas of bivalve, *Lamellidens marginalis* exposed to PoP for 15 days showing, digestive tubules (DT) with epithelium (E) and absorptive cells (A) and secretory cells (S), less vacuolated connective tissue (CT) and elongated lumen (L).