

Toxic Effect of Pulp and Paper Mill Effluents on Total Chlorophyll Content of Certain Free-Floating Aquatic Macrophytes

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Abstract

An exhaustive study has been done in regard to toxic effect of pulp and paper mill effluents on total chlorophyll content of free floating aquatic macro phytes in different concentrations of waste water at varying exposure duration. The result revealed reduction in total chlorophyll content of exposed aquatic macro phytes at higher concentration of pulp and paper mill effluents.

Keywords: Pulp and paper mill, Effluents, Aquatic macro phytes, Chlorophyll content.

Introduction

Water the most abundant and natural resource is extremely essential for the survival of all organisms but today clean water has become a precious commodity and its quality is threatened by numerous sources of pollutants. Paper mill has generated a great concern about the hazardous pollutants continuously released in to water bodies. The growth of paper mill is an index of social, cultural, industrial and economic development of countries direct discharge of effluent of Yas Paper mill, Darshan nagar Ayodhya (U.P) India, in to the farming are as and fresh water bodies without proper treatment contributes significantly to the water pollution (vishen et al. 2012)¹.

The use of phyto toxicity tests as a part of eco toxicology is relatively under developed. Aquatic plants especially macrophytes have been found to be extremely sensitive to industrial effluents. Therefore, the objective of present study was to evaluate phyto toxicity tests for complex paper mill effluents. For the purpose three free floating aquatic macro phytes were selected and tested. Aquatic plants in some samples showed lesions and loss of green pigments (chlorosis); others showed localized dead tissues that phyto toxicity tests with aquatic of paper mill effluents because of their simple culture, sensitivity and cost effectiveness. In the present investigation effect of paper mill effluents of various concentrations of paper mill effluents on

chlorophyll content of three free floating aquatic macro phytes have been tested.

Materials and Methods

To study the effect of paper mill effluents on chlorophyll content of three free floating *Eichhornia crassipes*, *Lemna minor* and *Pistia stratiotes* aquatic macrophytes, the plants were collected from natural fresh water sources. The toxicity experiments were carried out in the plastic through of .A litre capacity of equal volume in which healthy plants were kept with 3 litre of each effluent concentrations (100%, 75%, 50% and 25%) of paper mill for 7, 14, 21 and 28 days exposure duration. A control sets were maintained separately. Total chlorophyll content as mg/g fresh water was estimated in 80% chilled acetone extract of exposed plant leaves (Arnon, 1949) ² .

Result and Discussion

Reduction in total chlorophyll contents (as mg/g fresh water) of selected three free floating aquatic macrophytes (viz. *Eichhornia crassipes*, *Lemna minor* and *Pistia Stratiotes*) after exposure to various concentrations (25%, 50%, 70%, & and 100) of untreated paper mill effluents is given in the Table 1, Data given in the table 1 revealed that the effluent concentrations and exposure duration impart significantly alteration in chlorophyll contents of free floating aquatic macrophytes. At higher effluent concentrations total chlorophyll content

Table.1

Effect of various concentrations of paper mill effluents on total chlorophyll concentration of paper mill effluents on total chlorophyll content (mg/gfw) of free –floating aquatic macrophytes at varying exposure duration.

Plants	Effluent concentration (%)	Exposure Duration (days)			
		7	14	21	28
<i>Eichhornia crassipes</i>	Control	1.677 (0.00)	1.688 (0.00)	1.694 (0.00)	1.698 (0.00)
	25	1.365 ⁺⁺ (18.50)	1.76 ⁺⁺ (30.61)	1.035 ⁺⁺ (38.82)	0.976 ⁺⁺ (42.65)
	50	1.286 ⁺⁺ (23.21)	0.955 ⁺⁺ (43.49)	0.876 ⁺⁺ (48.28)	0.787 ⁺⁺ (53.64)
	75	1.128 ⁺⁺ (32.65)	0.755 ⁺⁺ (55.35)	0.653 ⁺⁺ (61.53)	0.586 ⁺⁺ (65.62)
	100	1.036 ⁺⁺ (38.14)	0.633 ⁺⁺ (62.58)	0.554 ⁺⁺ (67.39)	0.470 ⁺⁺ (72.38)
<i>Lemna minor</i>	Control	0.972 (0.00)	0.978 (0.00)	0.985 (0.00)	0.996 (0.00)
	25	0.773 ⁺⁺ (20.53)	0.657 ⁺⁺ (33.65)	0.579 ⁺⁺ (41.43)	0.548 ⁺⁺ (45.08)
	50	0.728 ⁺⁺ (25.16)	0.535 ⁺⁺ (45.40)	0.488 ⁺⁺ (50.67)	0.428 ⁺⁺ (57.15)

	75	0.625 ⁺⁺ (35.56)	0.405 ⁺⁺ (58.58)	0.358 ⁺⁺ (63.86)	0.307 ⁺⁺ (69.10)
	100	0.574 ⁺⁺ (41.02)	0.336 ⁺⁺ (65.85)	0.292 ⁺⁺ (70.35)	0.242 ⁺⁺ (75.64)
Pistia Stratiotes	Control	1.558 (0.00)	1.572 (0.00)	1.580 (0.0)	1.588 (0.00)
	25	1.260 ⁺⁺ (19.26)	1.067 ⁺⁺ (32.11)	0.945 ⁺⁺ (40.33)	0.903 ⁺⁺ (43.27)
	50	1.86 ⁺⁺ (24.00)	0.875 ⁺⁺ (44.46)	0.805 ⁺⁺ (49.19)	0.708 ⁺⁺ (55.43)
	75	1.035 ⁺⁺ (35.57)	0.670 ⁺⁺ (57.44)	0.586 ⁺⁺ (62.90)	0.532 ⁺⁺ (66.63)
	100	0.946 ⁺⁺ (39.30)	0.567 ⁺⁺ (63.92)	0.496 ⁺⁺ (68.60)	0.415 ⁺⁺ (73.98)

(Values in parentheses represent percent (%) inhibition in total chlorophyll contents) **
p< 0.1

Decreases significantly on prolonged exposure duration (Kumar 1994)³. The significant decrease in total chlorophyll content may be possibly due to metal toxicity (Visen et al. 2011)⁴ as well as due to influence of abiotic environment and uneven pH of exposure medium (Vishen et al. 2009)⁵. The metal toxicity is supposed to reduce chlorophyll biosynthesis by reacting with –SH group of amino lerulinic dehydrotase.

It is might be due to the toxic constituent induced inhibition of electron transfer mechanism in photo system II. The maximum inhibition of total chlorophyll contents of exposed aquatic macrophytes was recorded in 100% effluent concentrations after 28th day of exposure.

Conclusion

From the present study , it is concluded that following exposure to different concentrations of paper will effluents at

varying durations , the total chlorophyll content of exposed three free floating aquatic macrophytes was reduced significantly (p< 0.01). The maximum inhibition or reduction in chlorophyll content was found in 100% concentration of paper mill effluent at maximum days (i.e. 28 days) of exposure. All the three species of aquatic macrophytes however improve their total chlorophyll content in 25% concentration of paper mill effluent at minimum days (i.e. 07 days) of exposure. Decreases significantly on prolonged exposure duration (Kumar, 1994)³. The significant decrease in total chlorophyll content may be possibly due to metal toxicity (vishen et al., 2011)⁴ as well as due to influence of abiotic environment and uneven pH of exposure medium (vishenet al. 2009)⁵. The metal toxicity is supposed to reduce chlorophyll biosynthesis by reacting with –SH group of amino lerulinic dehydrotase. It is might be due to the toxic constituent induced inhibition of electron transfer mechanism in photo system II .The maximum inhibition of total chlorophyll

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