TOXICITY OF LINEAR ALKYL BENZENE SULPHONATE ON SOME AQUATIC PLANTS

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(Received March 1, 1988; revised October 27, 1988)

Abstract. The effect of different concentrations of linear alkyl benzene sulphonate under laboratory conditions on *Salvinia molesta* Mitchell, *Hydrilla verticillata* (L.f.) Royle, *Ceratophyllum demursum* L., *Lemma minor* L., *Spirodea polyrhiza* (L.) Schleid, and *Pistia stratiotes* L. was studied. A dose dependent effect on protein and chlorophyll a and b contents leading to substantial changes were noticed in the ultrastructural features as evident from scanning electron microscopy.

1. Introduction

Synthetic detergents like linear alkyl benzene sulphonate (LAS) used in household cleaning may pose serious ecological disturbance after finding their way into rivers and ponds (Pfahler *et al.*, 1981; Lewis, 1983). Phytotoxicity of detergents to terrestrial plants has received some attention (Singh and Orsenigo, 1984; Markwell and Thornber, 1982; Chawla *et al.*, 1986). A comparative account on the ecological effects of synthetic detergents on the various species of fauna under laboratory conditions has been reported earlier from this laboratory (Lal *et al.*, 1983). Such comparative studies on species variation among different species towards the same pollutants under comparable conditions have been limited. Therefore, the present study of the response of some aquatic plants to the detergent was undertaken.

2. Materials and Methods

The plants such as *Salvinia molesta* Mitchell, (Salviniaceae), *Hydrilla verticillata* L.f. Royle, (Hydrocharitaceae), *Ceratophyllum demursum* L. (Ceratophylaceae), *Lemma minor* L. (Lemnaceae), *Spirodea polyrhiza* Schleid L. (Lemnaceae) and *Pistia stratiotes* L. (Araceae) were collected from natural habitat maintained by Department of Botany, Lucknow University. The vascular plants were acclimatized in laboratory by growing in modified Hoagland's solution (EPA, 1975) for 7 days in continuous fluorescent light (Philips), 200 μmol m⁻² s⁻¹ at 25 ± 0.5 °C. Plants were transferred into fresh medium, twice before the treatment.

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One hundred mL of culture medium was taken in 250 mL flasks, autoclaved at 15 lbs pressure for 15 min. Neutralized LAS was added to the medium to produce final concentrations of control, 0.003, 0.005, 0.01, 0.05, and 0.1% (v/v). Three plants from the laboratory mother culture were inoculated in each flask for each species. Plants were harvested after 48 hr of exposure. There were four replicates for each experimental condition.

A 20% homogenate (w/v) was prepared by homogenizing in a Potter Elvehjem homogenizer in chilled distilled water under chilled conditions at maximum speed for 2 to 3 min.

The protein content of treated and untreated plant material was estimated by the method of Lowry et al. (1951). In order to avoid interference by pigments in assay of protein, the trichloro acetic acid precipitates were washed twice with 90% acetone for the extraction, prior to protein estimation.

Chlorophylls were extracted by taking weighed pieces of the leaves of plants in 95% acetone under cold conditions for 20 hr. Estimations of chlorophylls a and b are done by spectrophotometry (Arnon, 1949).

Pieces of leaf material were washed in distilled water, dehydrated in ethanol series, critical point dried and coated with gold-palladium alloy in JFC 1100, ion sputter coating unit. Observations were made with JEOL jsm, 35-C scanning electron microscope at 30° tilt and 10 kV.

3. Results and Discussion

After 48 hr of treatment the plants showed signs of etiolation and brown coloration indicating loss of chlorophyll content in treated cultures. A 0.003% LAS solution caused drastic decrease in the total chlorophyll content. The decrease was 63% in Hydrilla, 44% in Pistia, 48% in Lemma, 14% in salvinia, 45% in Spirodella, and 41% in Ceratophyllum as compared to their respective controls.

With an increase in the concentration of LAS (0.05%), total chlorophyll content of all the plants decreased. The decrease was 79% in Hydrilla, 86% in Pistia, 78% in Spirodella, 72% in Ceratophyllum, 85% in Salvinia, and 87% in Lemna (Figure 1). Changes in chlorophyll a/b ratio in various cases did not follow a definite trend.

Protein contents of plants are given in Figure 2. Apparently, all the detergent concentrations were inhibitory to tissue building except in submerged species, Hydrilla and Ceratophyllum, where LAS concentration of 0.05% appeared to be beneficial for protein synthesis.

The floating plants appeared to be more resistant to low concentration of LAS, but a concentration higher than 0.01% were found to be inhibitory. Total protein of Salvinia was reduced to only 25% of that of the corresponding control on the above concentrations of detergents.

A definite inhibitory effect of LAS in a dose dependent manner was recorded in Lemma minor which otherwise is the most resistant of all species studied. Various concentrations of LAS, in their increasing concentration caused about 7%, 14%, 25%,