Bull. Environ. Contam. Toxicol. (1998) 60:944-948

Bulletin of Environmental Contamination and Toxicology

Accumulation Of Phenol By *Potamogeton crispus* from Aqueous Industrial Waste

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Received: 18 September 1997/Accepted: 7 April 1998

Potamogeton crispus is a plant of rapid growth, high biomass production Donald (1984) and capable of removing pollutants from domestic and industrial waste effluents Fisher (1988). Most of the previous investigations of uptake of ions by the aquatic plants were static assays of short duration. The removal of metal ions from waste solutions was studied DeBusk (1986) and Blum and Speece (1990) according to the environmental conditions such as temperature, pH and ionic strength. Several studies Dirilgen and Inel (1994) Philips (1977) showed the possibility of using of some aquatic plants in biological treatment of water. The uptake of phenol has also been reported Wolverton et al (1976). Phenol is found in large amount in some industrial waste. Chemical conventional methods for its removal could be used. However, at low concentration these methods are impractical.

The present work investigated the use of *Potamogeton crispus* plant as an alternative method for the removal of phenol from aqueous industrial waste.

MATERIALS AND METHODS

Potamogeton crispus plants are distributed in Egyptian canals, the leaves are alternate and occur as a floating and submersed leaves. The leaves shapes were broadly ovate to narrow and hair like. The stems are slender and branched. Flowers are small and crowded into elongate or globose spikes that may be above or below the water surface.
The plants were collected from Ismailia canals, Egypt. The experiments were performed during spring, summer and autumn at temperature range from 20 to 28°C and at constant humidity.

For each experimental condition, 20g of *Potamogeton crispus* plant was placed in 200ml of phenol concentration of 25%, 0.5% and 1%. The pH of the solutions were adjusted to 5±0.5 using combined calomel and glass electrodes.

At regular time intervals, the sample was taken and measured spectrophotometrically using UV-160 and quartz cell of 1 cm length. The spectrum ranged from 200-300 nm. Since the plant transpiration rate is high, the solution volume was constantly monitored during the uptake period and bidistilled water was added to maintain the volume constant at 200ml.

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RESULTS AND DISCUSSION

Immersion of *Potamogeton crispus* plant in concentration of 0.25%, 0.5% and 1% of phenol solution showed an accumulation of phenol inside the plant. After 6 days from immersion in 1% of phenol solution, the plant changed to dark in colour and then died.

The effect of pH of phenol solution on the uptake process by the plant was studied. Samples of 20 g of *Potamogeton crispus* plant were immersed in 200 ml in presence of 1% of phenol solution. The pH was adjusted to a value ranging from 2.0 to 7.5.

The obtained results cleared that, the maximum uptake of phenol by *Potamogeton-crispus* plant occurred at pH lies between 5 and 6.5. At pH< 5 and at pH > 6.5 the uptake of phenol by *Potamogeton crispus* decreased. As the pH decreased than 5 or increased than 6.5 the uptake of phenol by the plant decreased. The acidity and alkalinity of the medium affect harmfully the plant cells, thus the amount of phenol absorbed by *Potamogeton crispus* plant decreased.

The effect of temperature on the uptake process by *Potamogeton crispus* was performed in which groups of 20 g of *Potamogeton crispus* plant immersed in 200 ml of 1% of phenol. The pH of solution was adjusted to 5.5 ± 0.2. The temperatures of the solutions were fixed at 20, 25, 30, 35 or 40°C. The results showed that, the most suitable temperature for the uptake process of 1% phenol by *Potamogeton crispus* plant was lied between 25 to 30°C. Temperature is an important factor during the uptake process of phenol by the plant. At low temperature less than 25 and at temperature > 35 the vitality and the activity of the plant were inhibited, Accordingly the amount of phenol absorbed by the *Potamogeton crispus* decreased.

The effect of phenol concentration on the uptake process by *Potamogeton crispus* was investigated. The concentration of phenol was determined spectrophotometrically. The pH of solution was adjusted at 5.5 ± 0.5 and the temperature was fixed at 25 ± 3°C. Fig. 1. shows the absorbance of phenol, after different immersion time between *Potamogeton crispus* and phenol solution. Fig.2. shows the percent uptake of phenol solution from 0.25%, 0.5%, 1% of phenol absorbed by *Potamogeton crispus* as a function of immersion time. Fig.3. shows the amount of phenol absorbed by one g of plant, The obtained results showed that *Potamogeton crispus* absorbed the totality of phenol from aqueous solution of concentration equal to 0.25% and 5% of phenol. The amount of phenol absorbed by one *g* of *Potamogeton crispus* after 6 days of immersion was found to be 30mg.

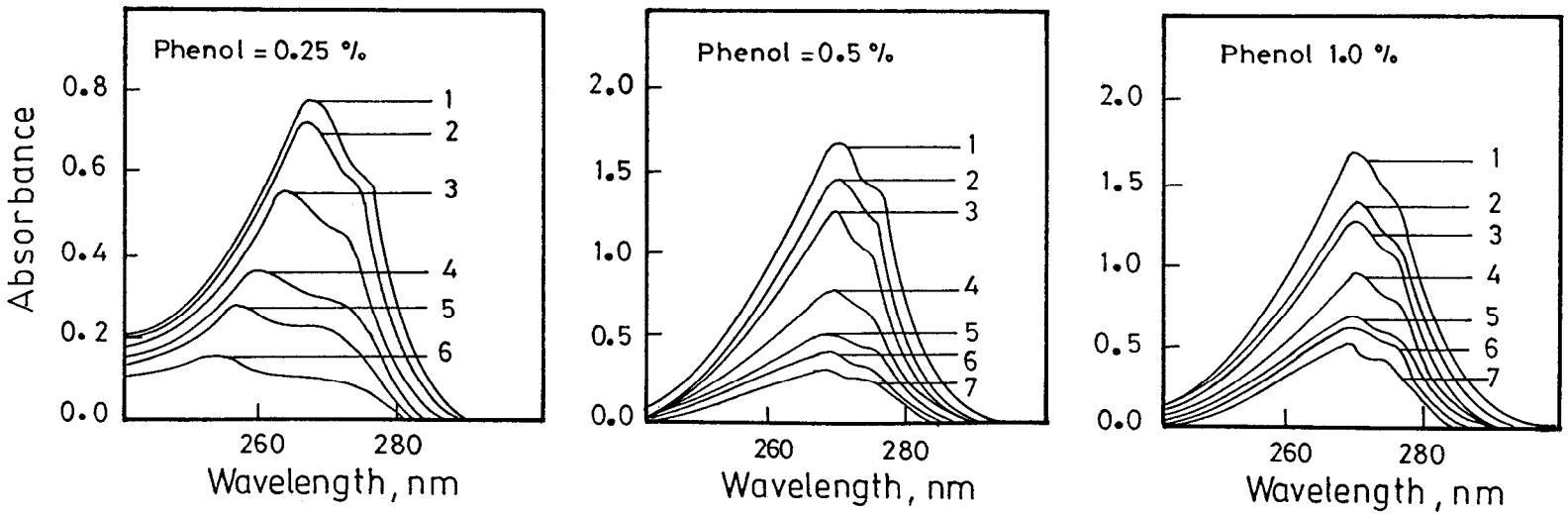

Figure 1 . Absorption spectra of phenol solution of different concentration at different contact time by *Potamogeton crispus* .

l - t = 0 2 - t = 2h 3 - t = 1d 4 - t = 3 d

5 - t = 8d 6 - t = 10d 7 - t = 13d.

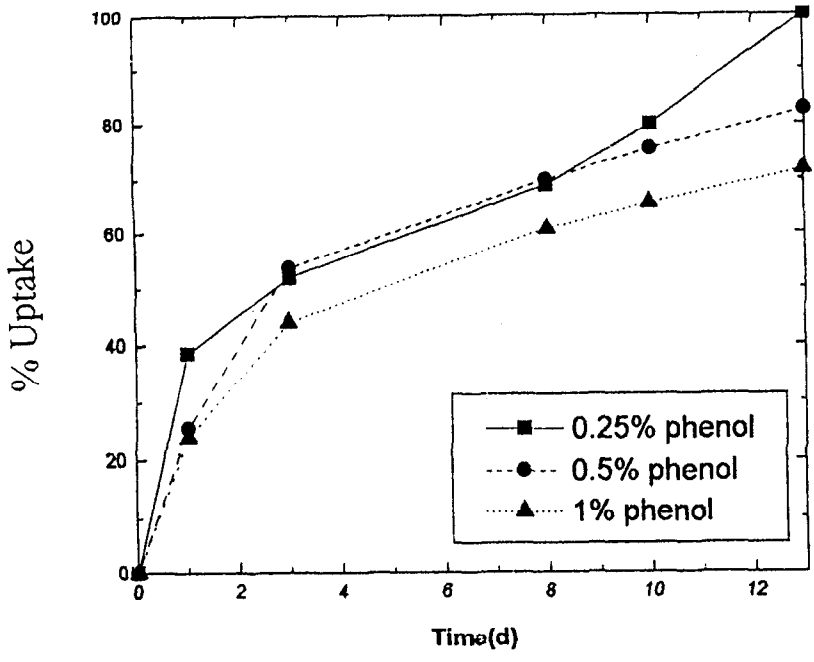

Figure 2 . Variation of percent uptake from different concentration of phenol solution by *Potamogeton crispus* at different contact times .

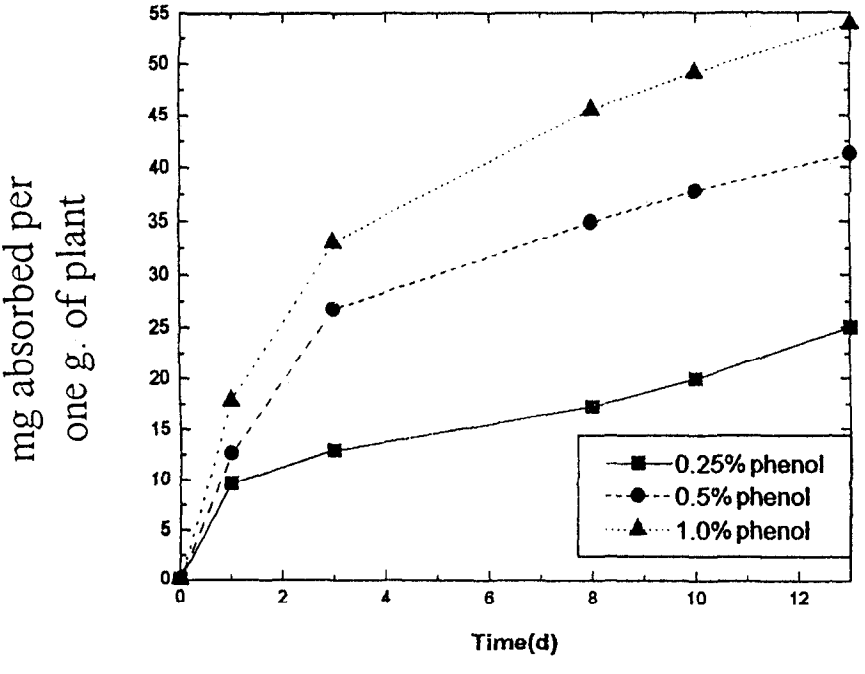

Figure 3 . Variation of the absorbed amount of phenol solution mg/g in *Potamogeton crispus* at different contact times .

For concentration of 1% only 40% of phenol was uptaken and the plant was dead after 6 days of immersion. *Potamogeton crispus* can absorb phenol from its diluted solution. At pheno concentration 21%, the plant absorb the phenol hardly due to phenol toxicity which affect the uptake process.

The uptake of phenol by *Potamogeton crispus* plant from industrial wastes contained phenol namely coal tar was obtained from industrial companies. An amount of 1g washed waste was added to 200ml of bidistilled water in a separating funnel and agitating for 15 minutes. The aqueous phase was taken and the quantity of phenol was determined and it found to be 0.5%. The pH of the solution was adjusted to 5 ± 0.5 and the temperature was fixed at 25 ± 3°C. Then 20g of *Potamogeton crispus* was placed in contact with the phenol solution for 2 days. The results showed that the totality of phenol from industrial wastes was absorbed by *Potamogeton crispus*

From the above results, it can be concluded that, the *Potamogeton crispus* plant was capable to remove significant amount of phenol from both industrial and aqueous wastes solution.

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