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Investigation of the influence of *Ceratophyllum demersum* to refine diluted compost latex

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ABSTRACT: Water pollution has always been a major problem in the environment. Polluted water is harming for human health and need to clean water from pollution factors. One of the economic and rapid methods for elements removal is displacement metals by biosorption. The purpose of this study was refining diluted compost latex by *Ceratophyllum demersum* that was diluted 200 times with distilled water. Diluted compost latex (DCL) accompany with aquatic plant *Ceratophyllum demersum* was located in bottles which were 6 liter in four replication. The experimental performed at the open air of Khorasgan (Isfahan, Iran) University area for 18 days without aeration. Result of Chemical oxygen demand (COD) indicates that the COD was decreased from 728 mg/L to 189.5 mg/L. Also, this investigation was demonstrated that the amount of ammonium in diluted compost latex was decreased from 60 meq/L to 13.33 meq/L. The amount of nitrate in diluted compost latex has decreased from 90 meq/L to 26.66 meq/L, and the amount of Phosphorous was declined from 1.2 meq/L to 0.21 meq/L. EC of diluted compost latex was reduced from 1.02 ds/m to 0.74 ds/m. All of the consequences which were mentioned indicated that this aquatic plant (*Ceratophyllum demersum*) is one of the best natural ways to refine Polluted water. @ JASEM

Key words: *Ceratophyllum demersum*, compost latex, Water pollution, COD

Pollution of the environment with toxic metals has been attracting considerable public attention over the past few decades (Li and Thornton, 2001). Environmental engineers and scientists are faced with the challenging task to develop appropriate low cost technologies for effluent treatment (Ahluwalia and goyal, 2007). An important dimension of water resources that has not received due attention is its quality aspects. The rapid industrialization in developing countries has resulted in heavy losses to economic welfare in terms of effects on agricultural activities, human health, and ecosystem at large through air and water pollution (Reddy, 2006). Compost latex is one of the important environmental pollution and also bearing membrane technologies and evaporation recovery. The moisture content of urban solid wastes is very high. A large volume of latex is, therefore, produced in the process of converting these wastes into compost. The latex contains relatively large amounts of organic matter, plant nutrients, soluble salts as well as small amounts of some heavy metals (Gandomkar et al., 2002).

Conventional methods for removing metals from aqueous solutions include chemical precipitation, chemical oxidation or reduction, ion exchange, filtration, electrochemical treatment, reverse osmosis, membrane technologies and evaporation recovery. These processes may be ineffective or extremely expensive especially when the metals in solution are in the range of 1–100 mg L^{-1} (Nourbakhsh et al., 1994).

Aquatic plants play a significant role in biogeochemical cycling of toxic trace elements and are being increasingly considered for environmental phytomanagment (Prasad et al., 2006).

C. demersum (Coontail or hornwort) is a completely submersed plant and commonly seen in ponds, lakes, ditches, and quiet streams with moderate to high nutrient levels (Johnson et al., 1995).

It does not produce roots, instead it absorbs all the nutrients it requires from the surrounding water. If it is growing near the lake bottom, it will form modified leaves, which it uses to anchor to the sediment. However, it can float free in the water column and sometimes forms dense mats just below the surface .(Keskinkan.et.al., 2004).

The present investigation was carried out with respect to removal pollution without aeration from diluted compost latex by *C. demersum.*

MATERIALS AND METHODS

C. demersum plants were collected from Zayanderood River in spring season of 2009 (Isfahan, Iran, 32° 38' 30" N, 51° 39' 40" E). Samples were thoroughly washed with tap water to remove any soil/sediment particles attached to the plant surfaces. Compost latex in this study was diluted 200 times with distilled water because researching by Qiu-jin et al. (2007) indicate that wastewater with high COD concentration can cause a substantial damage to submersed plant. The plants were then placed in diluted compost latex in 8 bottles (volume 6 lit). The experiment was performed at the open air of Khorasgan University area under natural daylight for 18 days without aeration. Samples were collected for

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three periods of six days and compared with primary sample (before using *C. demersum*). After each collection from samples, volume of diluted compost latex that were evaporated was replacement with equal amount of distilled water.

NO_3 and NH_4 were measured according to standard method (keeney and Bremner, 1996). Phosphorous (P) was determined according to the estimation of available phosphorous in soil (Olsen et al., 1954). Electrical conductivity (EC) was measured according to comparison and extracts with saturation extracts (Hogg and Hurey, 1984) and COD was measured by COD meter. All of the data collected during this experiment were analyzed with Statistical Package for the Social Sciences (SPSS) software (version 16.0) and were compared with the Duncan's multiple range tests.

RESULTS AND DISCUSSION

NH_4 concentration in DCL: The concentration of NH_4 in DCL decreased from 60 to 13.33meq/l for each three periods of six days (Fig 1).

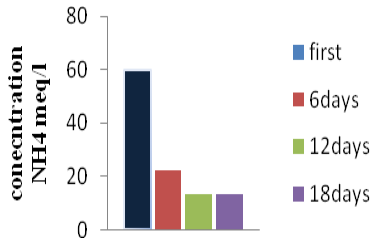

Fig 1. Removal of NH_4 from DCL

Unrooted submerged vegetation such as *C. demersum* requires nutrient uptake from the water (Mjelde and Faafeng, 1997). Tracy et al. (2003) showed that *C. demersum* is a nitrophile which can tolerance high nitrogen concentration and has very good removal effect on nitrogen in the water column.

NO_3 concentration in DCL: Figure 2 show that concentration of NO3 was decreased from 90 to 26.66 meq/l fter 18 days and from 90 to 22.5meq/l for the first two periods of six days, then concentration of NO3 increased from 22.5 to 26.66 meq/l for the last period of six days.

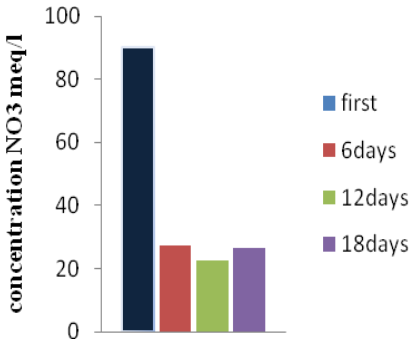

Figure 2. Removal of NO_3 from DCL

It has been well documented in studies by Allen (1971), McRoy et al. (1972), Wetzel (1969), Wetzel and Manny (1972) and Wetzel and Allen (1972) that appreciable amounts of dissolved organic matter (DOM), including soluble nutrients, are continuously being excreted by living aquatic vascular plants.

Phosphorous (P) concentration in DC: Analysis of P in samples showed that concentration of P decreased from 1.2 to 0.21 meq/l after 18 days. Gaoa et al. showed that submerged macrophytes could be used in reducing the P levels of nutrient enriched waters, and *C. demersum* had the best removal effect with the removal rates among other aquatic plants.

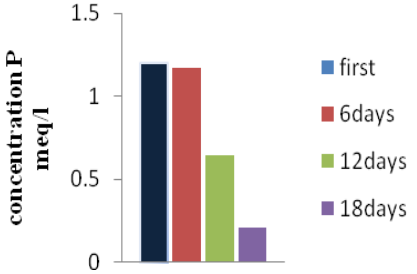

Fig 3. Removal of Phosphorous from DCL

COD concentration in DCL: The measured COD in diluted compost latex decreased from 728 to 189.5 mg/l for all three periods respectively (figure4).

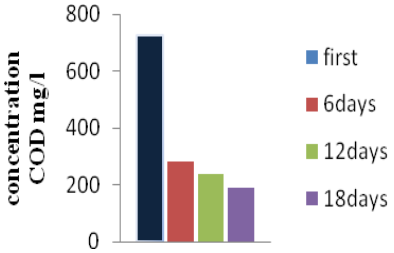

Fig 4. Removal of COD from DCL

Zimels et al. (2009) showed that aquatic plants can be used for design calculations regarding expected removal of pollutants by aquatic floating plants and Tripathi and Shukla (1991) showed that they can decreased COD and increased dissolved oxygen.
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EC concentration in DCL: The adsorption tests for EC showed (table 1) that *C. demersum* would reduce EC from 1.02 to 0.74 (ds/m) in treatment.

Table 1. Changes process EC (ds/m) in samples of treatment.

Treatment	EC (ds/m)			
	First day	6days	12days	18days
DCL	1.02	0.85	0.66	0.74

Foroughi *et al*. (2010) demonstrated *C. demersum* could decrease EC in aquatic environment including sewage and wastewater. Thus, considerable amounts of nutrients can be stored in plant dominated littoral areas of aquatic ecosystems (Kistritz, 1978).

Conclusion: From the work presented here, the aquatic submerged plant C. demersum can be an effective biosorbent for Phosphor, ammonium and nitrate. Also the data indicated that *C. demersum* increased oxygen dissolved in water and therefore COD decreased. EC decreased in polluted water by *C. demersum*. The aquatic plant *C. demersum* can play a major role in the environmental conditions of stagnant and flowing waters and this plant could adsorb elements and decrease pollution of compost latex. There for *C. demersum* could be utilized as a bioremediation for removal of pollution from wastewater.

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