



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 8.4  
IJAR 2021; 7(4): 175-177  
[www.allresearchjournal.com](http://www.allresearchjournal.com)  
Received: 18-02-2021  
Accepted: 21-03-2021

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## Role of (Salix Species) willow tree in Wular Lake for Phytoremediation

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DOI: <https://doi.org/10.22271/allresearch.2021.v7.i4c.8482>

### Abstract

Water bodies area unit primarily contaminated with serious metals thanks to increasing urbanization, intensive practices of agricultural and industrial developments, etc. serious metals are according to be highly nephrotoxic to human health since they're not simply disintegrated and rotten and may be bioaccumulated on the organic phenomenon. Therefore, serious metal contamination in aquatic ecosystems, such Macrophytes like water cress, Trapa etc., is of primary concern. the current study was initiated about role of the salix species as phytoremediator in wular lake. The macrophytes particularly edible components of *T. natans* accumulated metals from their encompassing water considerably.. Plants and plant communities are very important to humans and their environment. The quality of the air can be greatly influenced by plants. Plants can stop the movement of dust and pollutants. The salix species which plays a positive role in phytoremediation and have been proposed as a minimal effort, manageable, and environmentally stable answer for phytoremediation of trace metal debased land. The utilization of willow and poplar species in phytoremediation is promising (Dickinson 2000). Also, willows are easy to propagate and proliferate as well as quickly developing. They are likewise metal tolerant, perpetual, and with a broad root framework with high rate of evapotranspiration that can soothe pollutants (Hammer *et al.* 2003; Wilkinson 1999).

**Keywords:** macrophytes, wular lake, heavy metals, phytoremediation

### Introduction

Macrophytes, as a component of fresh water ecosystems, have diverse roles to play in the functioning of these ecosystems Baker, A. Grath, S. P., Sidoli, C.D., Reeves, R. D. (1994) <sup>[1]</sup>, They are directly involved in modifying the nutrient chemistry within the water by acting as nutrient sinks as well as source of nutrients. (Berndes G, Fredrikson F, Borjesson P. 2004) <sup>[2]</sup>. Besides, controlling the level of oxygen, macrophytes are also able to perform pivotal role in the biotic interactions of the littoral zone of shallow lakes and wetlands. The structural design of macrophytes within wetlands offers refuge for macro invertebrate communities and periphyton. Herbivorous invertebrates such as crayfish obtain their food directly from aquatic plants and some fish Bissonnette L, St-Arnaud M, Labrecque M. (2010) <sup>[3]</sup>.. Macrophytes provide an efficient method for removing contaminants from the water, which has resulted in the successful implementation of treatment wetlands. Macrophytes offer significant regulating services through the stabilization of shoreline and at the same time prevent erosion with the help of root structure. Amelioration of flood effects by slowing incoming water flow, thereby acting as a sponge is also among the significant ecosystem services provided by macrophytes. Wular lake one of the Asias largest lake is home to macrophytes of many species

The lake is drained in the northeast by the only single outlet in the form of River Jhelum.. The catchment of the lake is comprised of sloping hills of the Zanskar ranges of the western Himalaya on the northeastern and northwestern sides which drain their runoff through various nallahs, where Erin and Madhumati are prominent. On the eastern and southern sides are the lowlying areas of Sonawari which used to get inundated almost every year until numerous criss-crossing embankments were constructed along River Jhelum. The lake area thus reclaimed has in the recent past been brought under cultivation of paddy and plantations of willow, poplar, and fruit trees. On the western side in the Sopore-Watlab section, low-

lying areas have also been brought under paddy cultivation. In 1986, the lake was designated as wetland of national importance under the Indian Governments Wetlands Programme, and, in 1990, it was enlisted as a wetland of international importance under the Ramsar Convention of 1975. The fruit of *trapa* is an important source of food and the kernel is a good source of carbohydrates and minerals. Processed kernels are used to make chapati, and seem to be easily digestible. Its flour is used for making chapati. In certain tribal villages, the flour is used for treatment of diarrhoea and abdominal pain. However, they get laced with toxic metals growing in polluted water bodies Cloutier HB, Turmel MC, Mercier C, Courchesne F. (2014) [4], Although, the study regarding contamination of food crops with toxic metals and pesticides has received some attention, edible aquatic plants are virtually neglected. Cloutier HB, Turmel MC, Mercier C, Courchesne F. (2014) [4], further have reported the presence of carbofuran residue in *trapa* fruits after application and advocated reduced application of the pesticide or any other remedial measure to control the pest of crop.

### Heavy Metal Accumulation in wular lake

Wular lake is drained by many streams and nallas where Erin and Madhumati are prominent. The drainage in the wular has resulted in Accumulation of heavy metals in the wular lake is a potential risk to living system due to their uptake by plants and subsequent introduction into the food chain. The accumulation of heavy metals in soils and subsequently to the plants proves an increasing concern because of the potential human health risks. The accumulation of heavy metals in plants depends upon plant species, soil properties, and the efficiency of different plants in absorbing metals. It can be evaluated by either plant uptake or soil-to-plant transfer factors of the metals. The extent of accumulation of heavy metals is a direct proportionate of the concentration of the same in the soil. While taking the medium, cadmium, concentration in the soil under consideration, *Salix alba* is characterized by high extent of metal concentration. Accumulation of cadmium is very intensive and proves to be toxic. Copper (Cu) is also accumulated in the medium level by the *Salix alba*, while mercury (Hg) is highly accumulated by the plant. *Salix alba* has an intensive accumulation capability toward lead and zinc as well. The factors which influence the metalloid mobility in the soil are pH, concentration, and composition of organic compounds. Metals can be easily absorbed by the *Salix alba* when they are easily bioavailable and can be disseminated along the subsequent food chain which in turn causes mutagenic effects Cooper E. M, Sims J. T, Cunningham J. W, Berti WR. (1999) [5] The higher zinc and cadmium concentration is found in leaves than in the stem.

Pertinently, the zinc and cadmium fixations in the over-the-ground portions of the plant are highly variable which indicates that these two elements are not transferred to the aboveground parts of willows in a reasonable concentration. However the dynamics of the gathering, transport, and resilience is explicit for each metal. Another study by Greger M, Landberg T. (1999) [6] reveals the soil-to-plant transfer factor (TF), and it can be concluded that Pb and Cd are high accumulators. The study puts the tendency of TF for heavy metals in the order of Pb > Cd > Zn > Cu > Cr. The inoculation of microorganisms such as *Streptomyces*

sp., *Agromyces* sp., and *C. finlandica* is known to increase the accumulation of cadmium and zinc to shoots by increasing the bioavailability of Cd, Zn, and potassium (K) in polluted soil. The treatments of mycorrhizae are also known to increase the accumulation of Cu and the shoot biomass Cloutier HB, Turmel MC, Mercier C, Courchesne F. (2014) [4], The *Salix alba* L. in coordination with microorganisms and fungus prove to be the sources of enhancement for the process of phytoremediation. Purdy and Smart (2008) [10] envisaged that the hydroponic experiments along with the phosphates have decreased the toxicity and increased the accumulation of metals in the shoot tissues of *Salix alba*.

### However white willow L. Is Eligible for Phytoremediation

Cooper EM, Sims JT, Cunningham JW, Berti WR. [199] [5] Willows square measure the peculiar phyto extractors as they accumulate and tolerate metals. Moreover they're famous to make the dominant vegetation within the higher watersheds and crunches at higher reaches. several characteristics of the white willow create it the paramount phytoremediation agent. A triple-crown phytoremediator needs a high translocation rate from the foundation to the shoot (Greger and Landberg 1999) [6]. High biomass, metal translocation ability, and rising and development of the hamamelid dicot genus *salba* L. create it the helpful phytoextractor for the impure soils (Pulford and Watson 2003) [9]. The hamamelid dicot genus spp. have broad genetic variability and fast growth promptness. The metals that square measure accumulated within the higher biomass square measure ideal for gathering and the metals are often removed for good. white willow has a further money advantage of producing woody biomass which will be used as fuel and thus the plant could be a most well-liked one for the cultivation. Phytoextraction could be a machinery of the plants by that the contaminants taken up by the plant square measure used into a harvestable portion. it's been viewed as a less expensive and useful alternative for low defiled destinations as compared with different methods like excavation and soil laundry Hammer D, Kayser A, Keller C. (2003) Metal uptake and phytoextraction by the plants relies upon rates of the uptake and therefore the bioavailability of the metal to the plant. The elimination of the metals from the soil accomplished through the harvest typically consists of surface components. the utilization of hyperaccumulators has been prompt in the process of phytoextraction (Baker *et al.* 1994) [1] as they're famous to require up maximum quantities of a definite metal. Hyperaccumulators amass >0.01% of metallic element, >0.1% of copper, or >1.0% of atomic number 30 in dry mass of leaves (Baker *et al.* 1994) [1]. Willows accumulate elevated amounts of metallic element and atomic number 30 that's why the ash from willow contains ten times higher metallic element concentrations than from the opposite forest trees Pulford ID, Riddel-Black D, Stewart C. (2002) Phytoextraction of significant metals by hamamelid dicot genus has been investigated in husbandry studies (Watson *et al.* 2003) [9], in pot trials (Pulford ID, Watson C. 2003) [8], in contaminated soils (Bissonnette *et al.* 2010) [9], and in biosolid-amended soils (Purdy JJ, Smart LB. 2008) [10]. The same could be a analysis knowledge analysis done by Purdy JJ, Smart LB. 2008, [11], shows the uptake and transport of Cd, Zn, and atomic number 29 by white willow. According to the

information reportable by Rai UN, Sinha S. (2001) <sup>[12]</sup>, white willow is reasonable as a phytoextractor on low to tolerably metal tarnished soil owing to the way that the plant has high accumulation, high transport to the shoot of significant or substantial metals, and high take-up, a minimum of for Cd, Zn, and Cu. white willow likewise has high biomass generation and is as of currently in economic use (for bioenergy). In addition there's additionally a way for removing metallic element from the ash of the plant. The plant also can be bred to the clones that don't seem to be enticing to the animals. Harvesting close to the top of the season is understood to expel the best quantity of the metals. The concentration of the metals within the wood and therefore the bark looks to remain steady over the season or is increasing at the top of a season. The biomass

### **Role of Huntingdon willow (*Salix alba* L.) for cleansing Up the cytotoxic Metal**

264 is also increasing at the termination of the amount. The annual uptake magnitude relation by the *Salix alba* later on will increase by the co-harvesting of leaves similarly. It's famous that Cd availability within the soil will decrease with time victimisation hamamelid dicot genus cultures, but the rate of the decline is poorly famous. Pulford *et al.* (2002) <sup>[2]</sup> have represented that the concentration of EDTA-extractable Cd, Cu, Ni, and Zn in waste matter sludge-amended soil is higher at the location of white willow soil than in the other cultivation or within the unplanted areas. With the leaf fall, a substantial quantity of metals square measure recycled in the soil-stand surface of the white willow as compared with the stem gathering. Hence a promising preference for the management is to reap the leaves even so the wood which might decrease the danger of the natural order collection that's organic phenomenon.

### **Conclusion**

In view of this state of affairs of contamination of wular lake, there's a necessity for safeguarding the Huntingdon willow trees in wular lake. Plants with the aptitude of mitigating serious metal contaminations would be an affordable possibility for cleanup of all metal substances to acceptable levels in wular lake. Hamamelid dicot genus species square measure promising for the apply of phytoremediation of wular lake. Willows square measure ordered to proliferate and propagate invasive, metal-tolerant, with a widespread system and high evaporation and transpiration rates that square measure famous to clean the lake water and afterwards management to prevent metal transference to different cubicles of the system. Phytoremediation by Huntingdon willow (having an enormous economic value) offers ecofriendly machinery for standard remedy of the serious metals from the soil because the plant has a deep-root system likewise as high biomass yields

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