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Dr. S. G. Yadav



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Dr. S.G. Yadav

PHYTOREMEDIATION OF CONTAMINATED WATER BODIES

Avinash S. Agale and Mukundraj B. Patil

Department of Botany

Late Ramesh Warpudkar ACS college, Sonpeth, Dist. Parbhani (MS) INDIA

INTRODUCTION: Increase in population and use of agrochemicals or industrialization results in generation of large quantity of pollutants which is discarded into environment, which leads to be a pollution of abiotic components of environment like soil, water and air. We must have to remove pollutants from environment eco-friendly as they do not cause secondary pollution to the environment. There is an eco-friendly method to Clean contaminated water, air and soil by the use of living plants which is popularly known as 'Phytoremediation'.

According to Tsao David (2003) phytoremediation is defined as "the use of vegetation to contain, sequester, remove, or degrade inorganic and organic contaminants in soils, sediments, surface waters, and groundwater" is known as phytoremediation. According to 'Merriam Webster' company or dictionary the "phytoremediation" word was first of all used by Kathryn Sergeant Brown in 1991. The word Phytoremediation is composed of two different languages, in Greek (phyto means plants) and in Latin (remedium means restoring balance) i.e. the use of green plants to remove or

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balance the level of contaminants is called as Phytoremediation.(ThoughtCo.).

PHYTOREMEDIATION: There are various types of phytoremediation depending upon the source of remediation. This article specially focuses on the use of Phytoremediation for contaminated water. According to ThoughtCo website to clean contaminated water various types of Phytoremediation methods were used like phytoestimation, phytotransformation, phytofiltration or Blastofiltration, phytoextraction, phytodesalination, and phytovolatilisation, Phytosequestration etc. In 2020 Hasanuzzaman, M., & Prasad, M. Stated that Phytoextraction (also known as phytoaccumulation, phytoabsorption, or phytosequestration) and Phytofiltration is also known as Rhizofiltration, They also State that Phytodegradation, also called phytotransformation. These above mentioned methods are mechanisms of Phytoremediation (Awa & Hadibarata et al.2020) applicable to remove contaminants from the water.

a) Phytoextraction:

Due to low ability of terrestrial plants to translocate heavy metals from root to shoot, terrestrial plants have low potential for heavy metal accumulation as compared to the aquatic plants. [Ahmad et al.(2010)] *B. juncea* L. Czern, *B. napus* L. B. *juncea* L. *Azolla*, *Wolffia*, *Eichhornia*, *Lemna*, *Potamogeton*, *Spirodela* and these aquatic plant species has been used as phytoremediators, these species reduces the contaminants from contaminated water by bioaccumulation in their body parts or tissues. (Ansari et al.2020). Few *Brassica* spp. shows moderately enhanced accumulation of Zn and Cd. that species are and *B. rapa* L. (Lone et al.2008). Marigold (*Tagetes Minuta* L) helps in phytoextraction of zinc from wastewater, Zinc have

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Phytoremediation is an eco-friendly, cost free and sustainable way to remove contaminants from contaminated water. Phytoremediation remove contaminants like organic and inorganic compounds such as heavy metals. Phytoremediation is carried out by various plants such as *Azolla*, *Wolffia*, *Eichhornia*, *Lemna*, *Potamogeton*, *Spirodela*, *Wolffia B. juncea L. Czern.*, *B. napus L. B. juncea L.* *Azolla*, *Wolffia*, *Eichhornia*, *Lemna*, *Potamogeton*, *Spirodela*, *Azolla pinnata*, *Helianthus annuus L.*, *Phaseolus vulgaris L. var. vulgaris* etc. used in cleaning contaminants of water by mechanism of Phytoremediation like Phytoextraction, phytofiltration and phytodegradation.

REFERENCES:

- David Tsao (2003). phytoremediation . *Advances in Biochemical Engineering/Biotechnology*, vol.78.
- Hasanuzzaman, M., & Prasad, M. (2020). *Handbook of Bioremediation*. San Diego: Elsevier Science & Technology.
- Awa, S.H. & Hadibarata, T., 2020. Removal of heavy metals in contaminated soil by phytoremediation mechanism: A Review. *Water, Air, & Soil Pollution*, 231(2).
- Ahmad, A., Ghufuran, R., & Zularisam, A. (2010). Phytosequestration of Metals in Selected Plants Growing on a Contaminated Okhla Industrial Areas, Okhla, New Delhi, India. *Water, Air, & Soil Pollution*, 217(1-4), 255-266. doi: 10.1007/s11270-010-0584-9
- Ansari, A. A., Naeem, M., Gill, S. S., & AlZuaibr, F. M. (2020). Phytoremediation of Contaminated Waters: An eco-friendly technology based on aquatic macrophytes application. *The Egyptian Journal of Aquatic Research*, 46(4), 371-376. <https://doi.org/10.1016/j.ejar.2020.03.002>
- Lone, M. I., He, Z.-li, Stoffella, P. J., & Yang, X.-e. (2008). Phytoremediation of heavy metal polluted soils and water: Progresses and perspectives. *Journal of Zhejiang University SCIENCE B*, 9(3), 210-220. <https://doi.org/10.1631/jzus.b0710633>
- Bushra Awan; Maria Sabeen; Shahida Shaheen; Qaisar Mahmood; Abdolghaffar Ebadi; and Mohsen Toughani. Phytoremediation of zinc contaminated water by marigold (*Tagetes Minuta L*) *Central Asian Journal of Environmental Science and Technology Innovation* Volume 1, Issue 3, May and June 2020, Pages 150-158 10.22034/CAJESTI.2020.03.04
- Hseu, Z.-Y. et al., 2013. Using EDDS and NTA for enhanced phytoextraction of Cd by water spinach. *Journal of Environmental Management*, 117, pp.58-64.
- Kalve, S., Sarangi, B. K., Pandey, R. A., & Chakrabarti, T. (2011). Arsenic and chromium hyperaccumulation by an ecotype of *Pteris vittata* - prospective for phytoextraction from contaminated water and soil. *Current Science*, 100(6), 888-894. <http://www.jstor.org/stable/24076481>
- Das, S., Das, S. & Ghangrekar, M.M., 2022. Efficacious bioremediation of heavy metals and radionuclides from wastewater employing Aquatic Macro- and microphytes. *Journal of Basic Microbiology*.
- Dushenkov V, Kumar PBAN, Motto H, Raskin i (1995). Rhizofiltration: The use of plants to remove heavy metals from aqueous streams. *Environ. Sci. Technol*, 29:1239-45.

Vera Tomé, F., Blanco Rodríguez, P. & Lozano, J.C., 2008. Elimination of natural uranium and ²²⁶Ra from contaminated waters by rhizofiltration using *Helianthus annuus* L. *Science of The Total Environment*, 393(2-3), pp.351-357.

Lee, M. & Yang, M., 2010. Rhizofiltration using sunflower (*Helianthus annuus* L.) and bean (*Phaseolus vulgaris* L. var. *vulgaris*) to remediate uranium contaminated groundwater. *Journal of Hazardous Materials*, 173(1-3), pp.589-596.

Galal, T.M. et al., 2018. Bioaccumulation and rhizofiltration potential of *Pistia Stratiotes* L. for mitigating water pollution in the Egyptian wetlands. *International Journal of Phytoremediation*, 20(5), pp.440-447.

Yadav, B.K., Siebel, M.A. & van Bruggen, J.J., 2011. Rhizofiltration of a heavy metal (lead) containing wastewater using the wetland plant *Carex pendula*. *CLEAN - Soil, Air, Water*, 39(5), pp.467-474.

Abubakar, M.M., Ahmad, M.M. & U. Getso, B., 2014. Rhizofiltration of heavy metals from eutrophic water using *Pistia Stratiotes* in a controlled environment. *IOSR Journal of Environmental Science, Toxicology and Food Technology*, 8(6), pp.01-03.

Ankit Patani, Vikas Varekar, Jitendra Singh, Rutuja Naik., 2019. Phyto-desalination of Saline water 2nd International Conference on New Frontiers in Chemical, Energy and Environmental Engineering (Paper ID: M049INCEEE - 2019) 15-16 Feb, 2019, NIT Warangal, India

Islam, M.S., Hosen, M.M. & Uddin, M.N., 2018. Phytodesalination of saline water using *Ipomoea aquatica*, *Alternanthera philoxeroides* and *Ludwigia Adscendens*.

International Journal of Environmental Science and Technology, 16(2), pp.965-972.

Al-Baldawi, I.A. et al., 2015. Phytodegradation of total petroleum hydrocarbon (TPH) in diesel-contaminated water using *Scirpus Grossus*. *Ecological Engineering*, 74, pp.463-473.

Zazouli, M.A. et al., 2014. Phytodegradation potential of Bisphenol A from aqueous solution by *Azolla filiculoides*. *Journal of Environmental Health Science and Engineering*, 12(1).

Caçador, I. & Duarte, B., 2015. Chromium phyto-transformation in salt marshes: The role of halophytes. *Phytoremediation*, pp.211-217.

Retrieved from: "Phytoremediation." Merriam-Webster.com Dictionary, Merriam-Webster, <https://www.merriam-webster.com/dictionary/phytoremediation>. Accessed 1 Feb. 2022

Retrieved from: <https://knowhowtogmo.wordpress.com/2011/01/31/phyto-degradation/>

Retrieved from: How Plants Can Be Used to Clean the Environment. (2022). Retrieved 1 February 2022, from <https://www.thoughtco.com/six-types-of-phytoremediation-375529>


PRINCIPAL
Late Ramesh Warpudkar (ACS)
College, Sonpeth Dist. Parbhani