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WATER DEPOLLUTION USING *TYPHA ANGUSTIFOLIA*

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Abstract: Nowadays, heavy metals are a real problem for the environment and the human health. It's important to find different ways to deal with this problem. Phytoremediation is one of the possible methods. The aim of this research was to reviewed methods for removing copper and nickel pollutants from wastewater. To assess the efficiency of removal of copper and nickel were presented several methods for removing these pollutants through rush plant. Typha angustifolia is an aquatic macrophyte presented in this study for determination of its capacity to remove copper (Cu^{+2}) and nickel (Ni^{2+}) from wastewater. From literature it has been noted that 95% of copper, 80% of nickel was remove with Typha angustifolia in the wastewater having concentration of 0,01 mole/ L. It is noted that 92% of the pollutants have been removed from wastewater, in the experiment with the two combined heavy metals in a concentration of 0,002 M.
Keywords: phytoremediation, copper, nickel, typha angustifolia

1. INTRODUCTION

Nowadays, wastewater contains many pollutants because of the industries production. There are different kinds of pollutants like pesticide (Tripathy et. al. 2014), insecticide (Romeh, 2014) or heavy metal. In this study, we focused on heavy metals which are among the most toxic pollutants, more particularly on the copper and nickel. Even though copper is a crucial component for the growth of plants and also a benefic metal for human in small concentration, high concentrations of it have bad effects on human health and on plants growth. Enzymatic activities, photosynthesis or respiratory processes can be deteriorated (Monferrán et al. 2011).

2. PHYTOREMEDIATION TECHNIQUES – SHORT REVIEW

Different methods to remove these pollutants from wastewater exist. The problem with these methods is the cost to realize them. Moreover, these techniques have some disadvantages like high-energy requirements, incomplete removal or production of toxic sludge (Priyanka et. al. 2016). Then comes the phytoremediation technique which is eco-friendly and cheaper. Phytoremediation consist in using plants to remove pollutants and treatment of wastewater or soil. There are several kinds of phytoremediation techniques like:

- Phytoextraction is a subprocess of phytoremediation in which plants remove dangerous elements or compounds from soil or water, most usually heavy metals, metals that have a high density and may be toxic to organisms even at relatively low concentrations (Priyanka et. al. 2017).
- Phytodegradation which is also known as phyto-transformation is the breakdown of contaminants taken up by plants through metabolic processes within the plant, or the breakdown of contaminants surrounding the plant through the effect of enzymes produced by the plants.
- Phytovolatilization is a process, in which plants take up pollutants from soil and release them as volatile form into the atmosphere through transpiration. The process occurs as growing plants absorb water and organic contaminants (Priyanka et. al. 2017).
- Rhizofiltration is a type of phytoremediation, which refers to the approach of using hydroponically cultivated plant roots to remediate contaminated water through absorption, concentration, and precipitation of pollutants (Priyanka et. al. 2017, Galal T.M, et. al. 2018).
- Phytostabilization involves the reduction of the mobility of heavy metals in soil. Immobilization of metals can be accomplished by decreasing wind-blown dust, minimizing soil erosion, and reducing contaminant solubility or bioavailability to the food chain.

Many kinds of plant can be used to make phytoremediation like Eichhornia crassipes (Priyanka et. al. 2017), Azolla Filiculoides (Galal T.M, et al. 2018), Potamogeton Pusillus (Priyanka, et. al 2016) , Pistia stratiotes (Ugya et. al. 2015), Spirodela polyrhiza (Gini et al. 2017) or Salvinia molesta (Yin et al. 2016). In this study, we presented Typha angustifolia a plant of the Typha genus integrating the Typhaceae family. This family is characterize by these leaves which are long, strap-like, spongy. Plants fruit look like a cylindrical, brown spike. Typhaceae family grow in wetlands and need sunlight and fluctuating temperature to grow up (Abubakar M. M., et al 2014). Typha angustifolia plant is a perennial plant can reach 1-2 meters high with a sturdy stem. Its leaves are 4 to 8 mm wide and have a spur separated by a 1-4 cm long space. This plant grows particulary in ponds and rivers and flowered on June and July.

Some experiments have already be done using plant of Typha genus. The first one, used different plant including Typha latifolia to observe the capacity of these plants to remove copper, cadmium, arsenic or lead from industrial effluent. This article showed the best plant between Typha latifolia, Eichhornia crassipes, Salvinia molesta and Pistia stratiotes to

removed arsenic, copper and cadmium was Typha latifolia with a bio concentration factor (BCF) greater than the other plants (Sukumaran 2013). A second experiment used Typha latifolia to observe the capacity of the different parts of plant to remove chromium from wastewater. Firstly, this experiment show, Typha latifolia, remove chromium from the wastewater with a concentration of this heavy metal which is decreasing with time. This concentration passed globally to 9 mg/L after 48 hours to 3 mg/L after 164 hours. Secondly, the results showed that the roots remove more chromium that stems and leaves (Nithiyanantham et al. 2018).

About Typha angustifolia, an experiment has already been done to observe the accumulation of Cd, Cr, Cu, Fe, Ni, Pb and Zn through this plant. The conclusion of this research is that roots have a better bioaccumulation capacity for each pollutant than stems and leaves. Moreover, roots retire more Fe than other heavy metals. Typha angustifolia removes more Fe^{3+} with roots compared to other heavy metals (Ugya AY et. al. 2015).

Another experiment have be done with Typha angustifolia to remove copper ions from wastewater. In this experiment, result showed the plant remove 78% of copper with a concentration of 0.002 mole/L after 119 hours (Cristescu et al. 2018).

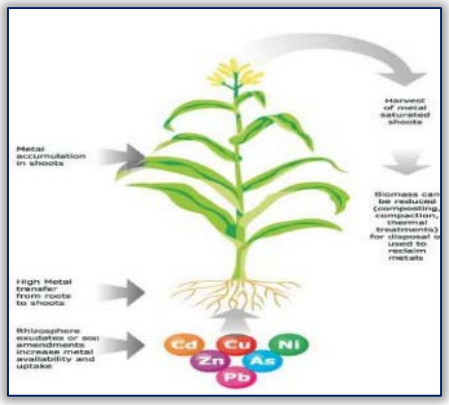

Figure 1 - Schematic representation of the processes involved in the phytoextraction of metals from soils

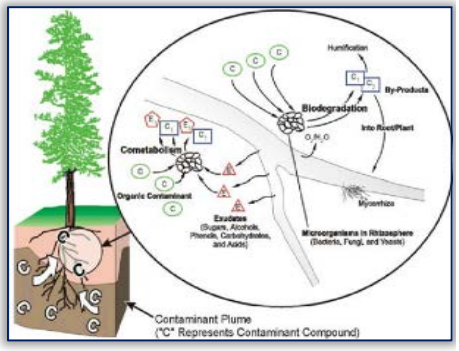

Figure 2 - Schematic representation of the processes involved in the phytodegradation of metals from soils

Figure 3 - Typha angustifolia plant («Typha angustifolia | Online Atlas of the British and Irish Flora»)

3. CONCLUSIONS

From literature data it can be said that *Typha angustifolia* plant is efficient to remove heavy metals from wastewater. Some experiments were done to observe the capacity of removing copper, cadmium, arsenic, chromium, iron, nichel, zinc or lead from industrial effluent. It was observed that the roots have a better bioaccumulation capacity for each pollutant than stems and leaves. Moreover, roots retire more Fe than other heavy metals.

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References

[1] Ugya AY, Imam T., Tahir S. The Use of Pistia stratiotes To Remove Some Heavy Metals from Romi Stream: A Case Study of Kaduna Refinery and Petrochemical Company Polluted Stream, 2015, pp.48-51;
[2] Cristescu C., A., Covaliu C., Popa L., Dumitru D., Anghelet A. Study on Use of Typha Angustifolia L. in Wastewater Treatment: Promising Method in Removal of Copper Ions Present in Aquatic Solution, 17th International Scientific Conference Engineering for Rural Development Proceedings, Volume 17 May 23-25, 2018, procedings book, pp. 714-720;
[3] Ali M., Z., Yousef M., Edris B., Davoud B., Phytodegradation potential of bisphenolA from aqueous solution by Azolla Filiculoides, J. Environ. Health. Sci Eng., 2014, pp. 12: 66;
[4] Monferrán, M. V., Pignata M. L. Wunderlin D. A... Enhanced phytoextraction of chromium by the aquatic macrophyte Potamogeton pusillus in presence of copper, Environmental Pollution, 2011, 161, pp. 15-22;
[5] Yin Ng, Chieh Chan J. D., Phytoremediation Capabilities of Spirodela polyrhiza, Salvinia molesta and Lemna sp. in Synthetic Wastewater: A Comparative Study, International Journal of Phytoremediation, 2017, 18 (1), pp. 69-78;
[6] Nithiyanantham, S, Sudarsan J.S, R annadurai, K.S. Kumar, Heavy Metal Removal Using Different Parts of Typha latifolia, Journal of Bionanoscience, vol. 12, 2018, pp.1–5;
[7] Dipu, S., Anju, A. K., Salom Gnana Thanga. V. Phytoremediation of dairy effluent by constructed wetland technology, Environmentalist 31 (3), 2011, pp. 263-268;
[8] Privanka. S.. Omkar S.. Supriva S. Phytoremediation of industrial mines wastewater using water hyacinth, Int. J. Phytoremediation. 2017. 19(1). pp.87–96;
[9] Galal T.M, Eid E.M, Dakhil M.A, Hassan L.M, Bioaccumulation and rhizofiltration potential of Pistia stratiotes L. for mitigating water pollution in the Egyptian wetlands., Int. J. Phytoremediation., 2018, 16, 20(5), pp. 440-447;
[10] Dipu S. Phytoremediation of Heavy Metals from Industrial Effluent Using Constructed Wetland Technology, Applied Ecology and Environmental Sciences 1 (5), 2013, pp. 92-97;
[11] Tripathy, Satyajit, Bhagyasree Paul, Ranajit Kumar Khalua. 2014, Phytoremediation: Proficient to Prevent Pesticide Pollution, IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 1 Issue 10, 2014, pp. 282-287;
[12] Gini T. G., Jeya J. G. Phytoremediation of Heavy Metals from Municipal Waste Water by Salvinia molesta Mitchell, Haya: Saudi J. Life Sci.; Vol-2, Iss-3, 2017, pp.108-115;
[13] Abubakar M. M., Ahmad M. M., Getso B. U., Rhizofiltration of Heavy Metals from Eutrophic Water Using Pistia Stratiotes in a Controlled Environment, IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT), Volume 8, Issue 6 Ver. III, 2014, pp 1-3.