Study of Adsorption of Pb (II) and Ni (II) metal ions using low cost and effective biocarbon of herb Tridax procumbens

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ABSRACT - The study of easily available and low cost adsorbent of herb Tridax procumbens for the removal of Ni (II) and Pb (II) ions from synthetic wastewater. Heavy metals like Ni and Pb are toxic to aquatic as well as human being when present in high concentration therefore it is necessary to reduce metal concentration. Effluent should be properly treated before disposal in water streams. Adsorption study have been performed as effect of pH, contact time, adsorbent dose for removal of Ni (II) and Pb (II) ions concentration from wastewater.

KEYWORDS - Adsorption, Tridax procumbens, Wastewater, Ni (II).

I INTRODUCTION

Heavy metal pollution affects terrestrial, aquatic as well as atmospheric ecosystem. There is steady increase in numbers of industries to fulfill increasing demands of population. Heavy metals pollution is results of advancement of human life and industrialization. Heavy metals enters in ecosystem by effluent from various industries, domestic sewage, agriculture waste etc. Water pollution induced by heavy metals is the outcome of improper treatment of effluent before disposal in water bodies. It affects human as well as flora and fauna adversely [Swaminathan Adaikalam et al, 2015].

Heavy metals are generally considered those whose density exceeds 5 g per cubic centimeter [M.A. Barakat, 2011]. They are non-biodegradable, bio-accumulative causing physiological ailments in human beings [Naeema H. Yarkandi, 2014]. Nickel is one of the heavy metal may causes Dermatitis, nausea, chronic asthma, coughing, cancer of lungs, nose and bone when present in high concentration while maximum contamination limit of nickel is 0.02 mg/L [Mukesh Parmar et al, 2013] [Malairajan Singanan, 2015]. Pb is toxic to human beings as well as aquatic life when present above MCL level and it is 0.006 mg/ml. Lead poisoning may causes abdominal pain, cramps, constipation, nausea, vomiting etc [Cafer Saka et al, 2012]. It also affects the brain and nervous system, kidney damage and high blood pressure and can cause birth defects [Joshua N. Edokpayi et al, 2015]

Adsorption is the accumulation of heavy metals on biosorbent from wastewater [Aakanksha Darge, 2015]. It occurs due to interaction of metal ions with functional groups at the adsorbent surface [D.S. Malik, 2016]. A low cost sorbent is defined as one that is abundant in nature, or is a by-product or waste materials [Woranart Jonglertjunya, 2008]. Heavy metal removal by low cost sorbent is cost effective and eco-friendly method.

In this research study Tridax procumbens herb have been used as low cost biosorbents for removal of Nickel and Lead from wastewater.

II MATERIALS AND METHODS

Biocarbon preparation:

Whole plants of Tridax procumbens herb were collected and washed repeatedly with deionized water. Then plant material was sundried for few days and then grinded to make fine powder and soak in 1:1 HCl and kept in oven. Fine powder then washed with deionized water to remove excess acid and dried for two hours in oven. Resulted black colored powder kept in airtight container for further use as biocarbon. [Prachi N. Raut et al, 2019]

Fig. 1 Images of Tridax procumbens

Preparation of Ni [II] solution and Pb [II]:

Stock solution of 1000-ppm Ni (II) solution and Pb [II] prepared by dissolving NiCl2 and PbCl2 in distilled water respectively. This stock solution used to make test samples by dilution method. Standard 100-ppm Ni (II) solution prepared from stock solution. Metal ion removal is calculated by:

% removal of Ni ions = Co-Ct × 100/Co

Where Co is initial concentration of metal ions.

Ct is concentration of metal ions after

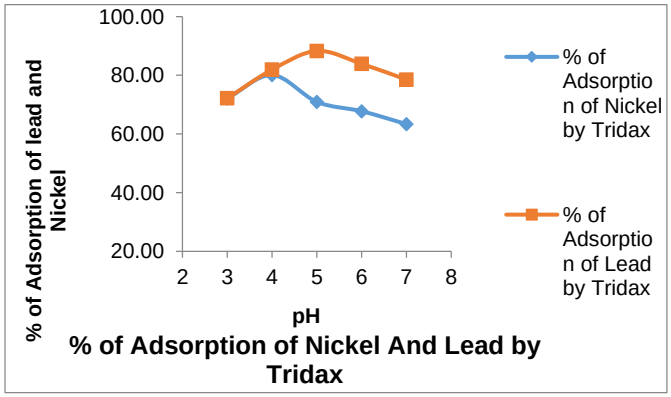
Adsorption process:

UV Spectrophotometer used to measure absorbance of solution before and after adsorption of heavy metals by biocarbon (C. Pragathiswaran et al, 2015), (Satish A. Bhalerao et al, 2015).

III RESULT AND DISCUSSION

Effect of pH:

pH is very crucial parameter to investigate the dependence on adsorption capacity of adsorbent because it affects the solubility of the metal ions, the degree of the ionization of the adsorbent [Abdunnaser Mohamed Etorki et al, 2014]. The maximum adsorption is achieve at pH 4 is 80.08% of Ni and 88.27% of Pb at pH 5 by Tridax. procumbens.



Sr. No	pH	% of Adsorption of Nickel	% of Adsorption of Lead
1	3	72.11	72.15
2	4	80.08	81.92
3	5	70.92	88.27
4	6	67.73	83.88
5	7	63.35	78.50

Effect of Adsorbent Dose: Adsorbent dose managed accessibility and availability of adsorption sites [Bernard E. et al, 2013]. Maximum adsorption shows at 2.5 g/100ml is 81.27% of Ni and 86.64% of Pb by biocarbon of Tridax procumbens.

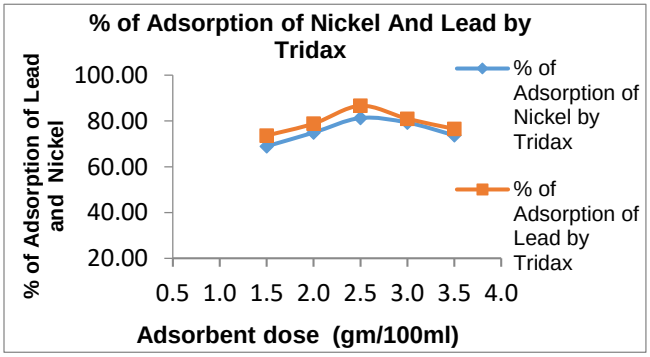


Fig. 3 Effect of Adsorbent Dose

Sr. No	Adsorbent dose(gm/100ml)	% of Adsorption of Nickel	% of Adsorption of Lead
1	1.5	68.92	73.62
2	2.0	74.90	78.83
3	2.5	81.27	86.64
4	3.0	79.28	80.94
5	3.5	73.71	76.55

Effect of Contact Time: The adsorption of metal ion is high in the starting because of availability of big surface area for the adsorption of the metals [Salman H. Abbas et al, 2014]. The optimum adsorption is at 120 minutes is 84.46 of Ni and 87.46% of Pb.

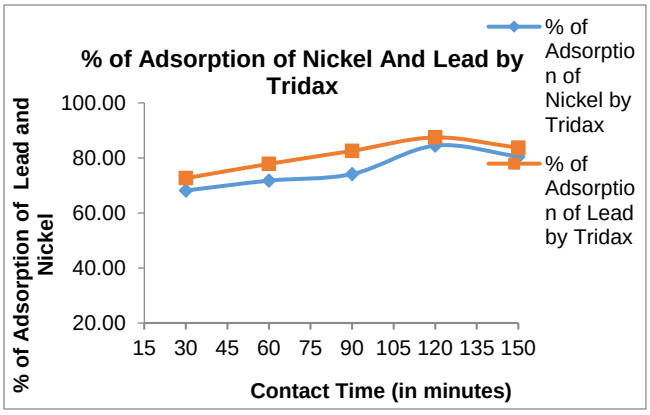


Fig. 4 Effect of Contact Time

Sr. No	Contact Time (in minutes)	% of Adsorption of Nickel	% of Adsorption of Lead
1	30	68.13	72.64
2	60	71.71	77.85
3	90	74.10	82.57
4	120	84.46	87.46
5	150	80.48	83.71

IV CONCLUSION

Tridax procumbens is ancient medicinal plant and easily available in agriculture fields. It found to be effective adsorbent for Ni (II) and Pb (II) ions from wastewater. The study shows removal of Ni (II) and Pb (II) ions feasible by adsorption on biocarbon prepared from herb Tridax procumbens. The optimum range for adsorption of Ni (II) ions was pH 4, adsorbent dose 2.5 g/100ml, contact time 120 minutes and for Pb (II) ions for pH 5, adsorbent dose 2.5 g/100ml, contact time 120 minutes.

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