Improve The Efficiency Of Moringa Seeds Extract And Used In The Removal Of Heavy Elements From Groundwater

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Abstract-Moringa Olivera seed was used as a sorbent for removing heavy metals namely lead (Pb), nickel (Ni) and cadmium (Cd) from contaminated groundwater were studied The optimum biomass doses were determined as 200 mg/L. M. Olivera seed has polar functional groups such as O–H, C=O, C–N, and others which facilitate the extraction of these heavy metal. differentparameterswereoptimizedsuchasM.Oliveraseeddosage,samplepH,contacttime and agitation speed. type of salt used for the extraction of coagulant, Collected water samples were dosed with varying concentrations of moringa Olivera seed extract: 50 mg/l, 100 mg/l, 150 mg/l, 200 mg/l and 250 mg/l. The collected water samples were analyzed before and after treatment with Moringa Olivera seed extracts at varying concentrations, M. Olivera seed had higher adsorption capacity than other reported sorbents. Shorter removal time with higher adsorption capacity removes heavy metal. Results showed that Moringa biomasses were able to remove the Pb, Ni and Cd WHO standards from higher Pb, Ni, and Cd initial concentrations which were up to 40 µg/L, 50 µg/L 9 µg/L,. Moringa seeds exhibited the highest removal of Pb (90%) Ni (85%) and Cd(99%).

Keywords – water treatment, Moringa Olivera seed, capacity removes heavy metal and groundwater

I. INTRODUCTION

Water is a vital resource necessary to sustain life. Sustainable freshwater supply and effective treatment are critical needs of many countries. In parts of many developing countries throughout Africa, Asia, and Latin America, access to adequate, clean fresh water remains problematic. Lack of access to fresh water supply in many of these developing countries has been the main cause of disease and infant mortality [1]. It was recently documented that 884 million people lack access to good quality drinking water [2]. In South Africa, before the non-racial democratic government took power in April 1994, approximately 15.2 million people lacked access to basic water supply [3]. Substantial progress has been made from 1994 onward as the government has worked to provide access to basic water to all citizens of the country. Even so, the demand for fresh water supply is still significant. Most people living in remote areas of developing countries are largely dependent on groundwater as a source of drinking water. However, the groundwater can be contaminated with various pollutants such as heavy metals. Heavy metals are present in groundwater due to poor land use practices including excessive use of agrochemicals. Average lead (Pb) levels of 287 µg/L and 330 µg/L have been recorded in groundwater samples collected from some areas in India and Pakistan, respectively [1, 2]. [2] reported that the average level of nickel (Ni) in groundwater in Pakistan was up to 960 µg/L. In Sri Lanka, Cd average levels in groundwater have been recorded between 5 to 23 µg/L [3]. The concentrations of the heavy metals far exceeded those recommended by WHO drinking water quality standards (10 g/L, 20 g/L and 3 g/L for Pb, Ni, and Cd, respectively). Therefore, it is of extreme importance to remove these harmful substances from the drinking water to prevent the potential adverse effects to human health. Poor economic situations in some developing countries require low-cost drinking water treatment solutions for the affected communities for which conventional/advanced drinking water treatment is not viable. Application of plant-based materials for drinking water treatment is environmentally sustainable, cost-effective as they are locally available, non-toxic, easy to prepare and the residual generated is easy to dispose of. Various natural-based materials have been studied as potential low-cost coagulants for water purification including Maringa Olivera (Moringa, MO) seed [7, 8]. MO seed is one of the popular natural materials investigated as it has shown ability in removing various pollutants such as copper, nickel, zinc, and color from water and wastewater [12, 14]. MO is a vegetable that can be found widely in Asian countries, growing well in any tropical areas including many in Africa. Besides, Musa Cavendish (banana peel, MC) was also reported to be a promising plant-based material for removing As, Pb and Cd [11, 12]. The use of MC in water purification fits well with the concept of environmental sustainability since the agricultural waste is recycled to minimize the wastes in an environmentally friendly way [13,14].

II. MATERIALS AND METHODS

2.1 Collection Of Moringa Oleiferaseeds

Moringa oleifera seeds were purchased from a local market in WadiNatrun

2.2 Preparation Of M. Oleifera Seedpowder:

The collected M. oleifera seeds were de-shelled and the endocarps were air dried under shade at room temperature for one week. Direct sunlight was avoided to prevent degradation of some of the plant photochemicals or antimicrobial constituents. The dried kernels were pulverized using electric blender to obtain powder. The powder was then sieved with a plastic strainer of small pore size to obtain fine powder. The fine powder obtained was stored in a sterile air-tight containerinadarkplacetoprevent oxidationandforfurtherextractionprocedure.

2.3 Preparation Of The Moringa Oleiferaextract

- A 1M NaCl solution was prepared and 5 g of Moringa seed powder were added to 100 mL of NaCl solution (the stock solution was thus considered to be 5% w/w).
- The NaCl solution with powder was vigorously stirred at pH 7 and room temperature for 30 minutes with magneticstirring
- The extract was then filtered twice: once through commercial filter paper in a funnel and once again through a fine filtering Millipore system (0.45 µm glass fiber).
- The result is a clear whiteliquid.
- Coagulant concentrations in the corresponding trials were referred to this particular extraction process, so the different dosages were calculated from the dry residue of this coagulant extract, excluding the amount of NaCl. Several studies have been carried out in order to characterize seed extract com position number of ions in small quantities (Ca2+, NO3−, PO43−) and a large amount of COD (around 15,000 mg L-1). Protein composition is included in a high Total Nitrogen (around 1,193 mg L-1).

2.4 Preparation Of Synthetic Groundwater Samples

Preparation of synthetic groundwater samples Synthetic groundwater samples containing individual Pb, Ni, and Cd of known concentrations was prepared with deionized water.All chemicals used in the study, including lead carbonate, nickel carbonate, and cadmium nitrate tetrahydrate. The chemical stock solutions with a concentration of 1000 mg/L of each heavy metal were prepared and then diluted to the target concentrations as per need for the experiments. The pH of the water samples was adjusted using either 0.1 M H2SO4 and 0.1 M of NaOH.

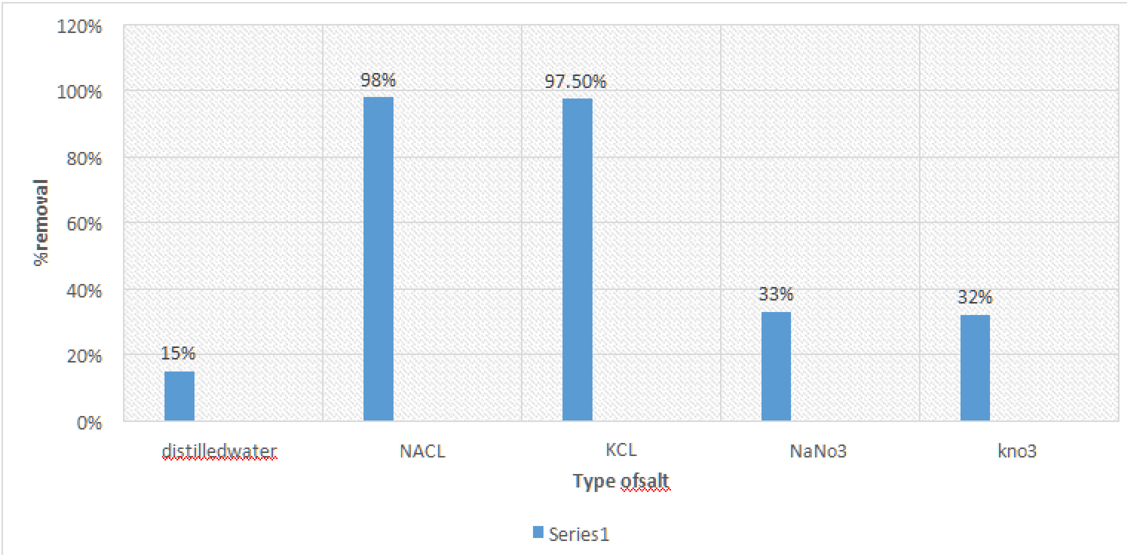
Table 1 presents the initial concentrations of the contaminants in the synthetic groundwater samples. The initial concentration values in this study were based on the mean groundwater quality values.

parameter	Unit	Initial concentratio n (ug/l)	Who drinking water quality stander
pb	ug/l	5,10,20,40,60,80,100	10
Ni	Ug/l	10,20,30,40,50,80,100	20
Cd	Ug/l	1,3,5,7,9,10,11	3
PH	Ug/l	7.0	6.5-8.5

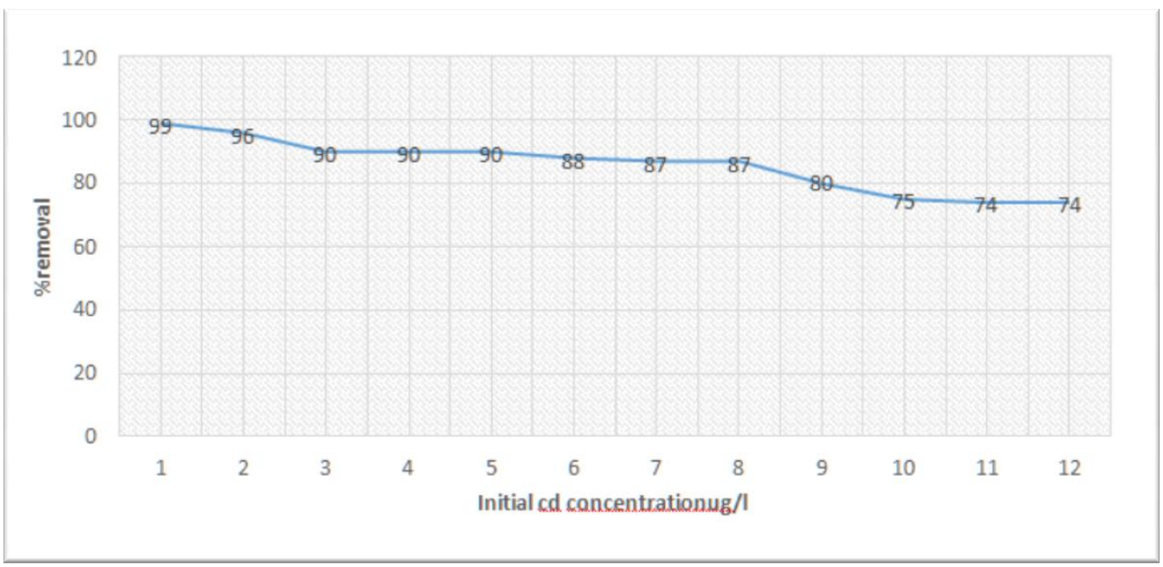
III. RESULTS

Effect of salt (type and concentration) on coagulant extraction It has been proven that the cationic protein in Moringa seeds does not dissolve well in water without using salt(Madronaet al. 2010). Thus, in order to extract active coagulant proteins from M. steno- petala seeds, four different salts (NaCl, KCl, NaNO3, and KNO3), in the similar concentration of 1 M, were used suggests that NaCl is the best salt for the extraction of coagulant from M. c seeds. This finding agrees with the result which was reported by the previous study for M. Olivera (Sajidu et al. 2006). To determine the effect of salt solution concentration on coagulant extraction, four NaCl salt solutions in various. concentrations of 0.5, 1, 1.5, and 2 M were chosen The results indicate that the coagulation activity of MSC enhances with increasing salt concentration up to 1 M and maximumof98.5%dyeremovalwasachievedby1MNaCl.

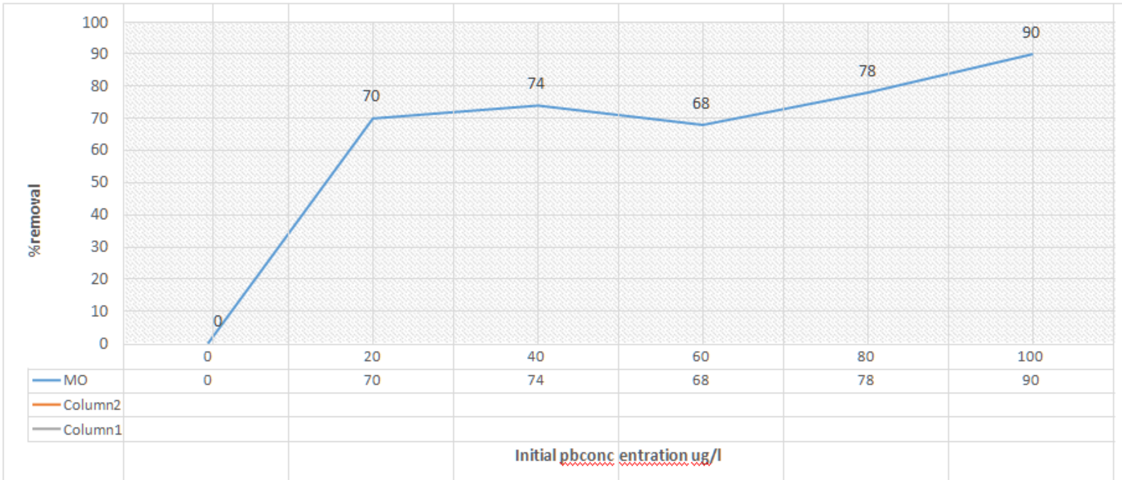
Effect of type of salt used for coagulant extraction on coagulation efficiency (pb concentration: 40ug/L, salt concentration: 1 M, MSC dose: 200 mg/L, pH 7)



The relationship between initial Cadmium concentration and removal efficiency at fixed dosages of 200 mg/L for MO



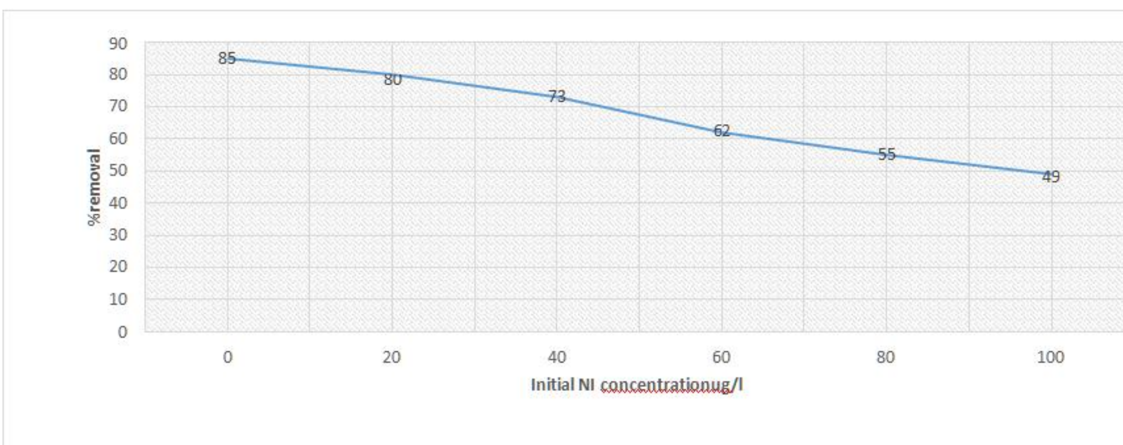
That the removal efficiency decreased rapidly from 99% to 74%with mo when ni concentration was increased from 1to 12µg/l.



The relationship between initial Pb concentration andremoval efficiency at fixed dosages of 200 mg/L for MO

The increase of initial Pb concentration from 5 µg/L to 60 µg/L increased the Pbremoval from 65% to 81%. However, Pb removal remained unchanged (around 80% to 81%) for concentrations between 60 to 100 µg/L. Similar to MO,

The relationship between initial NI concentration and removal efficiency at fixed dosages of 200 mg/L for MO



That the removal efficiency decreased rapidly from 85% to 49% with MO whenNi concentration was increased from 10 to 100 µg/L.

IV. CONCLUSIONS

Moringa biomasses were able to remove the Pb, Ni and Cd WHO standards from higher Pb, Ni, and Cd initial concentrations which were up to 40 µg/L, 50 µg/L 9 µg/L,. Moringa seeds exhibited the highest removal of Pb (90%) Ni (85%) and Cd (99%).

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