International Journal of Advanced Science and Research
ISSN: 2455-4227
Impact Factor: RJIF 5.12
www.allsciencejournal.com
Volume 2; Issue 5; September 2017; Page No. 90-92

Removal of copper from aqueous solution by using low cost adsorbent: A review

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Abstract
This study shows that, different pollutants present in the contaminated water Such Pollutants are Pb, Cr, Hg, Cu, Co and Ni etc. The copper is one of these very toxic metal present in waste water. Excess of copper cause health problems i.e. mental disorder, anemia, heart problems, arthritis, and etc. copper limit should be maintain at certain level. According to WHO, the maximum acceptable concentration of copper in drinking water is 1.5mg/lit. Now a days various low cost adsorbents used in adsorption process for the removal of copper from contaminated water. Adsorption has proven by many researches in the field of wastewater treatment as an effective and economically viable process.

Keywords: biosorbent, Cu metal, potato peels, adsorption process

1. Introduction

Over the last few decades environmental pollution caused by anthropogenic activities has increased exponentially and has reached alarming levels in terms of adverse effects on living organisms. Human activities such as mining, waste accumulation, industrial activities, road traffic and the use of agro-chemicals (fertilizers and pesticides) have caused extensive contamination of both surface and ground water with toxic heavy metals. Heavy metal discharge into aquatic ecosystems is a matter of concern. It is known that 11 metals namely Pb, Cr, Hg, Ur, Se, Zn, As, Cd, Co and Ni out of the 20 classified metals are referred to as toxic and are released into the environment in quantities which pose serious risks to human health (Bandela *et al.* 2016) [7]. Among these mina-Mata tragedy due to mercury poisoning and *"Itai-Itai*" disease in Japan due to cadmium toxicity are well known (Kumar 2006) [12]. Rapid industrialization has seriously contributed to the release of toxic heavy metals to water streams. (A Jafar Ahamad and A. Shajudha Begum 2012) [1]. Moradabad known as Brass City of India situated at a distance of 167 km from the national capital, New Delhi (NH-24), on the bank of river Rāmgangā and located at 28.830 N 780 E. It has an average elevation of 186 meters (610 feet) above sea level. The city is full of small-scale brass and steel industries. Most of these industries are in unorganized sector and thus have unplanned growth leaving to high degree of air, water and soil pollution. The most of the industries are dumping their wastes in Ram Ganga River pass from the heart of the city **(**Animesh Agarwal and Puneet Kumar Gupta 2014) [2]. Copper, an element which has been used by man for years, can be regarded as a longstanding environmental contaminant. Several industries like mining, printing, painting, dyeing, electroplating (Bandela *et al*. 2016) [7], battery manufacture and other industries discharge effluent containing Cu (II), to surface water (Ye *et al*. 2012) [4]. As Copper, Zinc & Iron and its compounds used in brass and steel industries, the continued intake of copper and Iron by humansleads to several severe diseases like mucosal irritation, depression, diarrhea and most dangerous lung cancer (Animesh Agarwal and Puneet Kumar Gupta 2014) [2]. Though copper at a lower concentration is essential for living organisms (Bandela *et al*. 2016) [7]. According WHO, the maximum acceptable concentration of Cu (II) in drinking water is 1.5 mg/L. The adult human body contains 100-150 mg of Cu (II), but excess amounts in the body can be toxic (A Jafar Ahamad and A. Shajudha Begum, 2012) [1]. Copper toxicity also called copperiedus, refers to the consequences of excess of copper in the body. Copper toxicity can occur as a result of intake of food and water containing excess copper (Bandela *et al.* 2016) [7]. Removal of metal ions from wastewater in an effective manner has become an important issue. Efficient methods for the removal of metals have resulted in the development of new separation techniques. Precipitation; ion-exchange, flocculation, adsorption, electro-chemical processes, electro dialysis, nano filtration and reverse osmosis are commonly applied for the treatment of wastewater (A Jafar Ahamed and A. Shajudha Begum 2012) [1]. However, these conventional techniques are associated with their limitations which include sensitive operating conditions, low efficiency, sludge production and also the disposal is expensive (Bandela *et al*. 2016) [7]. Among these methods, Adsorption is an alternative technology in which increased amount of study has been focused because of cost effectiveness; local availability & technical feasibility for the removal of heavy metal ions form the wastewater. Different factors affecting the adsorption as the contact time, adsorbent dose, pH and temperature were examined to optimize the adsorption equilibrium and the kinetic data are fitted using different models and parameters (A Jafar Ahamed and A.Shajudha Begum 2012) [1].

2. Sources of Copper

Different sources of copper such as, water pipes, Copper water

heaters, Frozen greens and canned greens using copper to produce an ultra green color, Alcoholic beverages from copper brewery equipment, Instant gas hot water heaters, Hormone pills, Pesticides, Insecticides, fungicides, Copper jewelry, Copper cooking pots and (Lakherwal 2014) [3] and discharge effluents from chemical industries, electroplating and tanning industries etc (Halnor *et al*. 2013) [11].

3. Toxicological effects of copper

Acute poisoning from ingestion of excessive copper can cause (Rana *et al*. 2014) [5] Mental disorders, Anemia, Arthritis/rheumatoid, arthritis, Hypertension, Nausea /vomiting, Hyperactivity, Schizophrenia, Insomnia**,** Autism**,** Stuttering**,** Postpartum psychosis**,** Inflammation and enlargement of liver, heart problem**,** Cystic fibrosis (Lakherwal 2014) [3]. Liver toxicity has been seen in doses high enough to cause death (Rana *et al*. 2014) [5]. But it can also cause headaches, fatigue, and depression, skin rashes, learning disorders and even lead to accumulation in the kidneys, brain, skin, pancreas and heart (Halnor *et al*. 2013) [11].

4. Adsorption Process

Adsorption experiments were carried out in batch mode at ambient temperature. Adsorption is a process that occurs when a gas or liquid solute accumulates on the surface of a solid or a liquid (adsorbent), forming a molecular or atomic film (adsorb ate). Adsorption is operative in most natural physical, biological, and chemical systems, and is widely used in industrial applications such as activated charcoal, synthetic resins and water purification.
(Renge *et al,* 2012*)* [13].

4.1 Low cost adsorbent

Definition

An adsorbent can be assumed as "low-cost" if it requires a little bit processing, is abundant in nature, or is a by-product or a waste from an industry. Natural material or certain waste from industrial or agricultural operation is one of the resources for low cost adsorbents. Generally, these materials are locally and easily available in large quantities. Therefore, they are inexpensive and have little economic value (Renge *et al*. 2012) [13].

Table 1: Removal efficiency of copper at different adsorbent.

Name of adsorbents	Dosages	PH	Contact time	Removal %	References
Coconuthusk	.2-1gm	7	30min	92	Oyedeji *et al*.,2010
Rice husk	100mg/ 100ml	7	20-180min	92.6	Ye *et al*. 2012 [4]
Coffee wastes	1gm	5	60-120min	94	Kyzas *et al*.,2013
Eggshell powder	.5-1.5gm	-	24hr	95	Agrawal *et al*.,2014
Mango seeds	1gm	-	30-90min	65.90	Ashtikar *et al*.,2014
Juliflora leaf powder	1gm	2-7	10-60min	89	Halnor *et al*. 2013 [11]
Banana peels	.05-10gm	6-6.5	24 hrs	94	Hossain *et al*.,2012
Syzygium cumini L seed power	.075-.175gm	7.0	360min	97.16	Pandey *et al*.,2014

5. Conclusion

This review study shows that, adsorption is a simple and attractive method for the elimination of heavy metals such as copper (cu). The adsorption method depends on such parameters, contact time, ph, adsorbent dose and temperature. Removal efficiency depends on nature of adsorbent and different adsorbent have different removal efficiency. It is found that, syzygium cumini L seed powder, egg shell powder, coffee waste and banana peels are more efficient as low cost adsorbent. Other waste as (potato peels) can be used as low cost adsorbent undoubtedly it will give good result. In future, low cost adsorbent can be used to reduce removal cost and increase removal percentage over conventional adsorbent.

6. References

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