PURIFICATION OF DRINKING WATER CONTAMINATED BY HEAVY METALS (Pb & Cu) BY USING PLANTS (PARTS)

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1. Introduction

Lack of pure drinking water to a large section of population especially in under developed & developing countries is an issue, which needs an immediate attention. Heavy metals like Lead (Pb) and Copper (Cu) are dangerous beyond certain limits [1]. Pb enters into drinking water system due to low mineral content, use of corroded pipes and fixtures with lead solders. Low-level continuous exposure of Pb leads to spectrum of injuries across multiple body system [WHO 2012]. In particular leading to reduced IQ, behavioral changes, reduced attention span and learnings problems. Cu seeps in water system due to deposition of industrial and municipal wastes along with corrosion [ATSDR 2011]. Though human body has inbuilt mechanism to excrete Cu, its exposure leads to nausea, vomiting and diarrhea especially in small children. The aim of this study is to examine the possibility of removing these hazardous metals from drinking water by employing plants like *Vetiveria zizanioides* (Khus-Khus roots) and *Solanum lycopersicum* (Tomato fruit & peel).

2. Experimental Setup

For research, Khus-Khus roots, Tomato fruit and peel were treated with Vinegar to overcome any interference by other chemicals. These were kept in drinking water samples for a period of 12hrs and 24hrs in multiple combinations followed by centrifugation and ultra-filtration. Concentration of Pb and Cu in the aqueous solution was determined by a standard method. Spectra of both metals in aqueous solution was recorded on atomic absorption spectrometer [2]. A standard calibration curve was obtained afterwards. These water samples along with untreated water samples were then subjected to AAS [3]. The amount of heavy metals removed from water (α) has been calculated by the formula:

$$\alpha = \frac{C_0 - C_1}{C_0} \times 100\%$$

where C_0 is the concentration of metals in untreated water samples and C_1 is the concentration of metals in treated water samples from different time periods

3. Results

Figure 1 shows the percentage reduction of metals in water by using plant (parts)
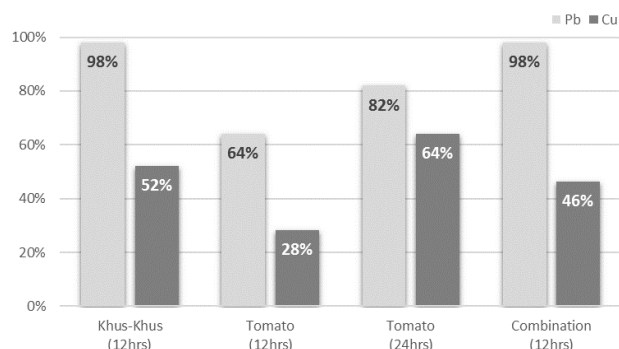

Figure 1 – Percentage reduction of metals by using plant (parts)

From the table, it can be clearly observed that *Vetiveria zizanioides* (roots) and *Solanum lycopersicum* (fruit & peel) helped in significant reduction of Pb from water individually as well as in combinations. However, their effect on Cu is comparatively less, but in 24hrs duration, tomato peel has effectively removed 64% Cu from water along with no drastic change in pH.

Metals	Drinking water	Khus-Khus (12hrs)	Tomato (12hrs)	Tomato (24hrs)	Combination (12hrs)
Pb	0.053	-0.029	0.019	0.0095	-0.0096
Cu	0.293	0.14	0.21	0.105	0.157

Table 1 – The influence of plant parts in reduction of concentration of metals in water (in ppm)

4. Conclusion

Use of plant parts individually and in combinations for different time intervals (12hrs and 24hrs) proved to be an effective method in considerably reducing Pb and Cu from water, without compromising on pH, odor and color. In further study, effect of plant parts on metals like As, Al, Ni needs to be carried out to explore complete removal of such metals from water to establish economically viable options for water purification.

5. References

[1] Pb (0.01mg/lt) and Cu (0.05mg/lt) (IS10500-2012 BIS)

[2] AA6300 (Shimadzu, Japan). Department of Environmental Sciences, University Of Delhi

[3] Tsade H.K. "Atomic absorption spectroscopic determination of heavy metals". Journal of Environmental Analytical Chemistry