

TITLE: PHYTOPRECIPITATION OF METALS FROM LIQUID AND WASTE WATER

ABSTRACT

The present invention discloses a novel method for bio-removal of heavy metals from liquid and waste water using fruits of *Cordia obliqua*. The method involves harvesting fruits of *Cordia obliqua* followed by separation of mucilaginous mesocarp of the fruit. The separated mesocarp was boiled to dissolve in warm water in a predetermined ratio to form an extract of plant product. This extract is added to waste water and pH, temperature are maintained at predetermined values. After a predetermined interval of time the precipitated metals are filtered to remove toxic heavy metals from waste water effluents.

We Claim,

1. A novel, simple, efficient, economically feasible method for bio-removal of heavy metals from effluents using fruits of *Cordia obliqua*, thereby achieving maximum removal of heavy metals in a short span of time, the said method comprises of following steps
 - a. Harvesting fruits of *Cordia obliqua* and separating mucilaginous mesocarp of the fruit.
 - b. Dissolving the separated mesocarp in warm water in a predetermined ratio to form an extract of plant product.
 - c. Adding the said extract to the said effluents and maintaining pH, temperature at predetermined values for a predetermined interval of time to form the metal precipitate.
 - d. Filtering the said metal precipitate to remove toxic heavy metals from effluents.
2. The method as claimed in claim 1 wherein the said ratio of mucilaginous mesocarp of the fruit and warm water is 1:20.
3. The method as claimed in claim 1 wherein the said pH is maintained at 5 to 11.
4. The method as claimed in claim 1 wherein the said temperature is maintained at 26 to 45° C.
5. The method as claimed in claim 1 wherein the time required for the formation of the said precipitate ranges from 5 minutes to 72 hours depending upon the metal.
6. The method as claimed in claim 1 wherein the percentage removal of heavy metals are in the range of 75 % to 95% depending upon the metal.
7. The method as claimed in claim 1 wherein the said heavy metals includes Aluminium, Chromium and Lead
8. The method as claimed in claim 1 wherein the percentage removal of Aluminium is 75%,
9. The method as claimed in claim 1 wherein the percentage removal of chromium is 97.7%

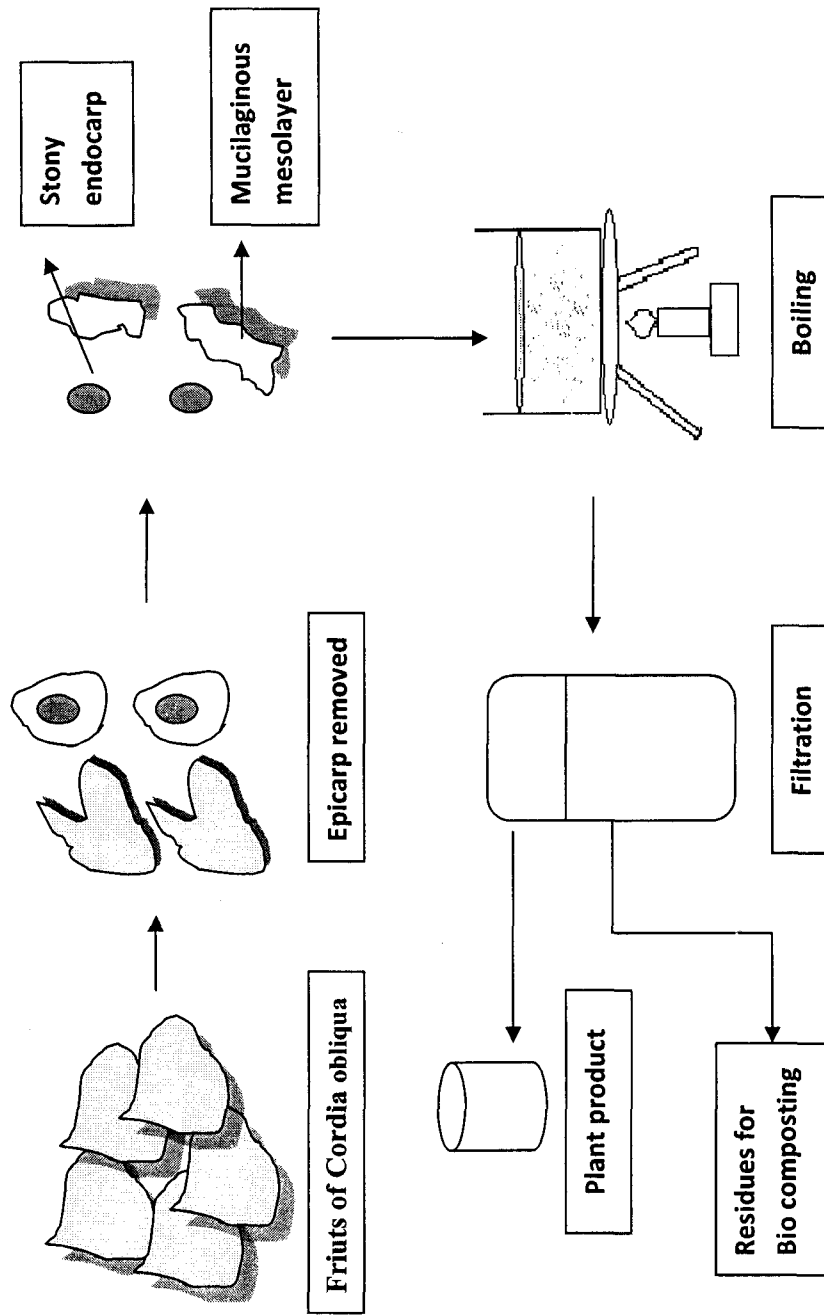
10. The method as claimed in claim 1 wherein the percentage removal of lead is 84%.

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For MARINA LABS

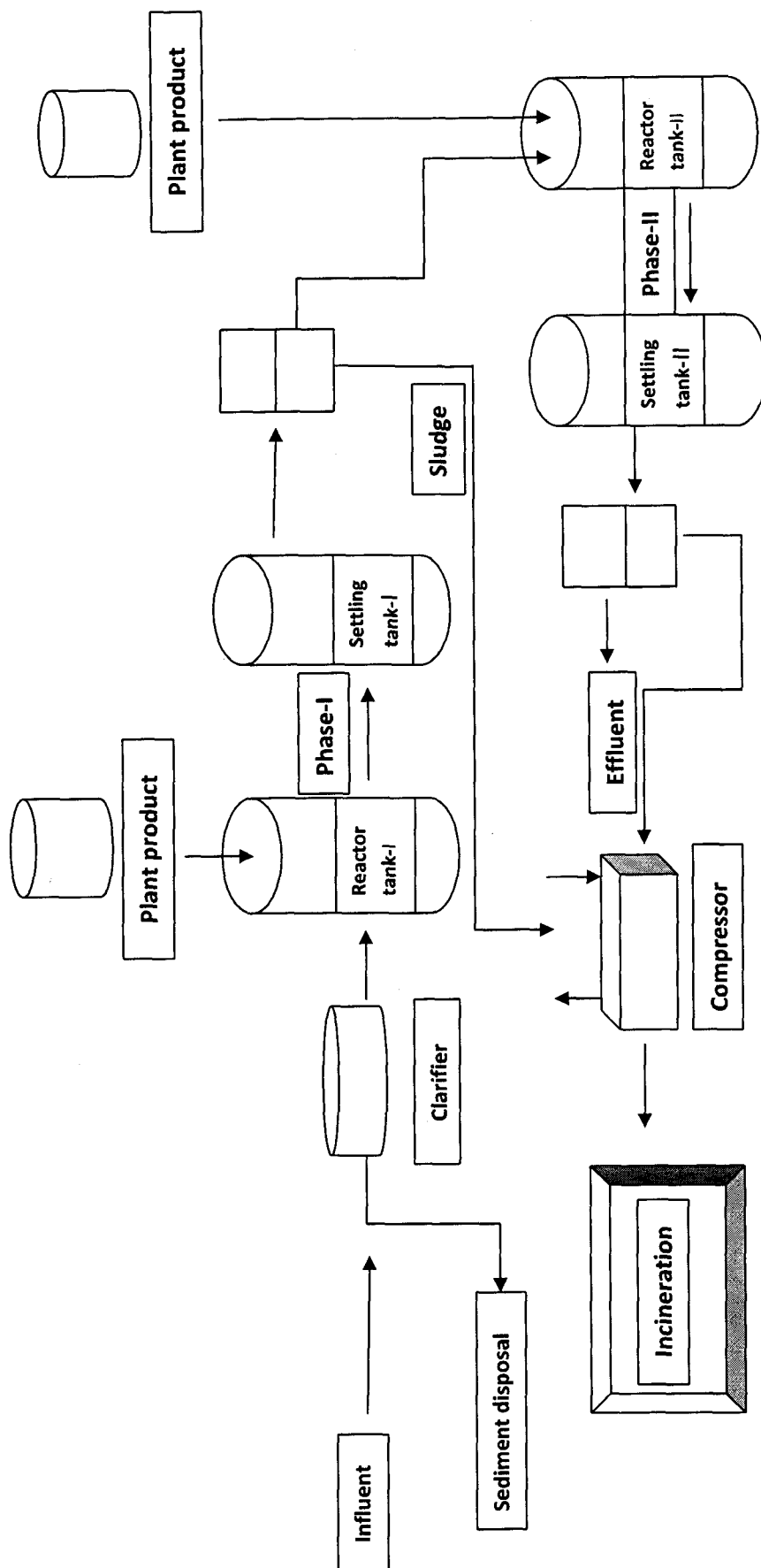


DIAGRAM – I: PREPARATION OF PLANT PRODUCT



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DIAGRAM – II: PROCESS DIAGRAM



The following specification describes the invention:

DESCRIPTION OF THE INVENTION

BIO-REMOVAL OF ALUMINIUM, CHROMIUM AND LEAD FROM LIQUID AND WASTE WATER USING FRUITS OF *CORDIA OBLIQUA*

The invention involves the removal of metals like Aluminium, Chromium and Lead from liquid and waste water using the extract of mesocarp of the fruit of *Cordia obliqua*. Phytomining (US 6,786,948 B1; US 5,711,784 A), Phytoextraction (US 7,268,273 B2), Phytodegradation, Phytolaching (US 7,718,063 B2), Phytovolatilization etc. are few of the techniques employed in removal of metals from waste water. However, there was no report available on the usage of fruits of *Cordia obliqua* in removal of metals from liquid and waste water.

Current methodology involves the removal of metals like Aluminium, Chromium and Lead using the mucilaginous mesocarp of the fruit of *Cordia obliqua* which form complex chemical reaction and serve as an adsorbent. The metal or metal complex or the precipitate of metal and complexes after completion of reaction is removed using a simple filtration system.

The fruits of *Cordia obliqua* were collected from Chennai city of Tamil Nadu state in India. The pericarp of the collected fruits was removed and only the mucilaginous mesocarp was used for the reaction. The mucilaginous mesocarp was separated from the stony endocarp by squeezing. The mucilaginous mesocarp was boiled in water or dissolved in warm water at the concentration of 1:20 ratio and this was used as a plant product for the treatment (Diagram 1) of metals like Aluminium, Chromium and Lead. Diagram 2 represents the treatment of liquid or waste water which possess Aluminium, Chromium and Lead.

The experiment was performed using the solution prepared with respective metallic salts to provide 1000ppm to 2000ppm of the metal in water. To this, the extract of plant product was added at a percent of 5 to 15. The pH and temperature ranges were maintained at 5 to 11 and 26 to 45° C respectively. The time period for the formation of the precipitate ranged from 5 minutes to 48 hours depending upon the metal. Filtration was carried out using cotton wad. This is considered to be the experimental procedure for Phase – I treatment. The filtrate of phase – I was analyzed through Atomic Absorption Spectrophotometer to detect the extent at which the respective metals were removed. The percentage of metal removal was calculated using the

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absorbance value of the control (untreated waste water) and the absorbance value after treatment. Based on the requirement, the experimental procedure of Phase – I was repeated for the Phase – II treatment to the filtrate obtained followed by analysis through Atomic Absorption Spectrophotometer. The filter cake was dried and examined through Scanning Electron Microscopy and Energy Dispersive X-ray Analysis Spectroscopy for the confirmation on the removal of respective metals from the waste water. Upon analysis, it was found that removal of specific metals ranges from 75 % to 95%. The sludge formed can be incinerated for recovery of metals.

References cited

US Patents:

7,718,063	05/2010	Jacquet
6,786,948	09/2004	Rufus L.Chaney et al.
5,711,784	01/1998	Jay Scott Angle et al.
7,268,273	09/2007	J. Scott Angle et al.

Other publications:

A State-of-the-Art report on Bioremediation, its Applications to Contaminated Sites in India; Dr. M.N.V. Prasad (March, 2011)

Gardea-Torresdey J L et al.; "Use of phytofiltration technologies in the removal of heavy metals: A review"; *Pure Appl. Chem.*, Vol. 76, No. 4; pp. 801-813; 2004.

Batool et al.; "Hexavalent chrome reduction by bacteria from tannery effluent"; *J.Microbial.biotechnol.*, Vol. 22, No. 4; pp. 547-554; 2012.

NOVEL FEATURES OF INVENTION

- First model to implement this technique.
- Loss of plant life is prevented. Only the fruits produced by the plant is used.
- In comparison with existing techniques, high percentage of reduction is achieved within a short interval of time.
- The amount of plant material required is low for reduction

ADVANTAGES OVER OTHER KNOWN ALTERNATIVES - NATIONAL AND GLOBAL

- The cost associated is less compared to other phytoremediation techniques.
- It can be implemented easily in industries with simple, inexpensive Effluent Treatment Plant setup.
- No pollution of environment since the invention does not accumulate metals in its plant part or transpire to the atmosphere.

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