



Journal of Applied Sciences

ISSN 1812-5654

science
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Process for Separating Heavy Metals from Industrial Residues by Using an Ultrasound Flotation and Eucalyptus as Sequestering Agent

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Abstract: The disclosed method relates to the process for the removal of heavy or toxic metals from residual, industrial or municipal waters and sludges to such an extent that the waters processed by flotation comply with the ecological standards. Tests were carried out in order to remove heavy metals in samples of residual industrial waters from electroplating plants. The methodology used is the ultrasound flotation in two steps, using in the first step a collector (which is generally heteropolar organic), a foaming agent (generally alcohol, surface active agents) which is a surfactant and, in the second step, eucalyptus cones (cup shaped receptacle) as sequestrants of copper or other elements which could not be removed in the first step because of their amphoteric character or because they redissolved by precipitation. Thus, due to the excellent recoveries obtained concerning copper, lead, nickel, iron and aluminum, residual industrial waters treated according to the disclosed process complied to the entire satisfaction with the Mexican standard NOM-066-ECOL-1994. Furthermore, recovered solids are metal precipitates in a complex status, are inert and harmless; they can be deposited with no danger at any location or, if they have a good concentration of metals, they can be sent to a plant for melting mineral concentrates.

Key words: Ultrasound flotation, collector, foaming agent

INTRODUCTION

The success of this method is because the conjugation of ultrasonic and flotation cell excitation. It is well known that ultrasonic excitation because of high frequencies can promote atoms and remove electrons. Also in a chemical reaction it is faster if the collisions between the particles are more frequently.

MATERIALS AND METHODS

Experimental study was conducted in two steps; tests were carried out in order to remove heavy metals in samples of residual industrial waters from electroplating plants.

In the first step it was used a collector in order to remove the more abundant of heavy metals. On the second step, was used eucalyptus cones (cup shaped receptacle) as sequestrants of copper or other elements which could not be removed in the first step.

Thus, due to the excellent recoveries obtained concerning copper, lead, nickel, iron and aluminium, residual industrial waters treated according to the disclosed process complied to the entire satisfaction with

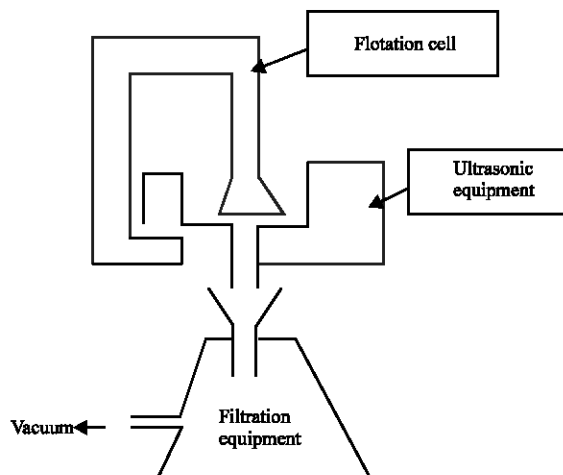


Fig. 1: Equipment used for removing heavy metals from industrial wastewater

the Mexican standards NOM-066-ECOL-1994. Furthermore, recovered solids are metal precipitates in a complex status, are inert and harmless; they can be deposited with no danger at any location or, if they have a good concentration of metals they can be sent to a plant for melting mineral concentrates.

Table 1: Metallurgical balance on the final procedure with lime precipitation, eucalyptus and ultrasonic flotation

Products	Concentration of heavy metals from the original wastewater (ppm)				
	Cu	Pb	Ni	Fe	Al
Concentration original wastewater	71.50	58.50	261.50	155.50	22.50
Concentration of the wastewater processed	0.16	0.25	0.57	0.00	0.00
Permissible limit of Mexican standards NOM-066-ECOL-1994 (ppm)	0.50	0.60	2.0	1.0	2.0
(%) Of recovery of heavy metal from wastewater treatment	99.78	99.57	99.78	100.00	100.00

The development of the procedure is on the patent.

It was used a Sonogen bath, model D-100 and a flotation cell Denver. On Fig. 1, is the ultrasonic and flotation cell equipment used for removing the heavy metals from the industrial wastewater.

On Table 1 we can see the original wastewater (Table 1) the result of the procedure on the second step, the entire satisfaction with the Mexican standards NOM-066-ECOL-1994.

RESULTS

- This process can be applied to solids or industrial wastewater.
- It is a process unexpensive and efficient and easy to apply.
- The water treated can be used on the original industrial treatment.

REFERENCES

- US Patent Number 5,059,309, Jun 4/1994, J. Norman Stark *et al.*, Ultrasonic Flotation System.