Application of Carbon Nanofibers to recovery gold (III) from waste PCBs

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Abstract

Being gold a valuable metal, its recovery from various sources is a challenge both form an environmental and profitable point of view. In the treatment of the wastes printed circuit boards (PCBs) gold normally appeared after leaching the PCB's wastes with hydrochloric and nitric acids mixture in a volume relation (3/1). A solution containing gold (III) and valuables metals as commonly obtained.
This paper investigates the performance of carbon nanofibers in the recovery of gold (III) from these solutions.
The adsorption of gold (III) by carbon nanofibers (CN) system was studied. The influences of several experimental variables on gold adsorption were investigated, i.e. stirring speed of aqueous solutions, adsorbent dosage, acid concentration, etc.
The carbon nanofibers were obtained from Grupo Antolin carbon. The main characteristic of the material is presented in Table 1.

Table 1.-Characteristics and chemical composition (%) of the carbon nanofibers

Density	1.9-2.0 g/mL
Purity	>94 %
Particle Diameter	0.03-0.3µm
S_{BET}	107 m^2/g
Elemental Chemical Composition (wt,%)	C: 99.4; H:0.0; N: 0.03; O: 0.36

Figure 1a) shows the effect of the HCl concentration on the adsorption of gold (III) by the carbon nanofibers. More than 95% of gold (III) is adsorbed onto the carbon nanofibers after 30 minute of reaction. The adsorption of gold (III) was studied in presence of copper (III). The copper is not adsorbed by the carbon nanofibers. Under these conditions the 97% of gold is adsorbed.
Carbon nanofibers appeared to be a promising material for the recovery of gold (III) from this type of acid solutions.

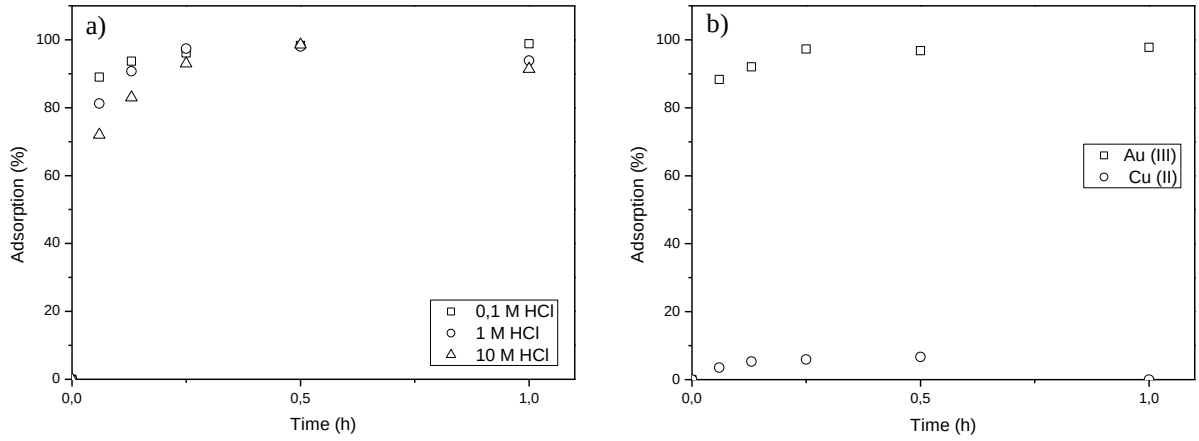

Figure 1.- a) Influence of the HCl concentration in the adsorption of Au (III), conditions; adsorbent dosage: 0.025 g (CN), aqueous phase: 0.05 g/l Au (III), temperature=20ºC, stirring speed: 2000 cm^{-1}. **b)** Mixture of gold (III) and copper (II), conditions; adsorbent: 0.1 g (CN), aqueous phase: 0.05 g/L Au (III) and 0.016 g/L Cu (II) in 6 M HCl, temperature 20ºC, stirring speed: 2000 cm^{-1}.

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