

SIIC012

LEACHING OF PRECIOUS METALS FROM WASTE PRINTED CIRCUIT BOARDS WITH DIFFERENT LEACHING REAGENTS

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Abstract:

Electronics is the biggest and fastest-growing manufacturing sector in the world. The global production of electronic waste is increased 3-5% each year due to the lifetime of electronic devices is continually minimized. Waste printed circuit boards is one of the electronic wastes. The recovery of precious metals inside printed circuit boards is necessary to prevent the depletion of natural resources. This study was carried out to evaluate various leaching reagents for precious metals. The alternative leaching reagent must be identified to replace the conventional method of leaching which is cyanide leaching. This is due to the toxicity of cyanide solution. Since the use of cyanide as a liquid solution has contributed to serious water contamination in different metal recovery plants worldwide, this serious problem is to be solved by using more environmentally friendly leaching agents as alternators for the leaching process. SALSA method which is part of systematic literature review (SLR) is used to collect, synthesize, and analyze data. A total of six leaching reagents are identified and presented collectively in this review paper. There are several studies were considered to assist with the choice of non-cyanide reagents for the precious metal leaching. The environmental effects of leaching should be taken more attention to evaluate the best leaching reagent in order to develop an environmental friendly leaching for the recovery of precious metal from waste PCBs. A critical comparison of six leaching reagents is analyzed based on screening and scoring method. This method compared the total of six alternatives of leaching reagents with selected criteria like leaching rate, reagent cost, toxicity level, corrosivity level and its research level. From the result obtained, thiourea, thiosulfate and iodide leaching have been recommended to replace cyanide leaching more efficiently.

Keywords:

Electronic waste, Recovery, Leaching, Precious metals, Waste printed circuit boards

Objectives:

- To review different leaching reagents that greener for precious metals from waste printed circuit boards.

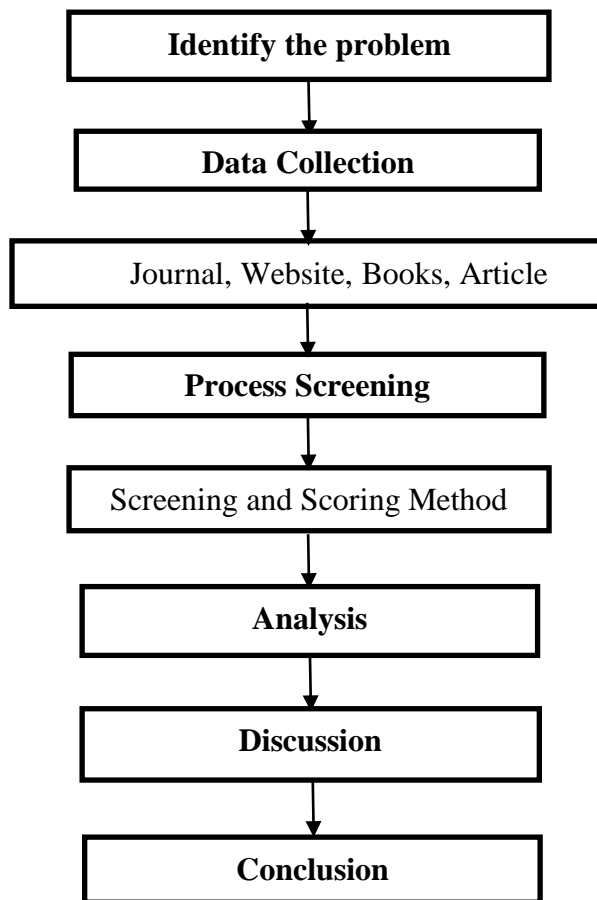
Methodology:**Results:**

Table 1: Comparison between different leaching reagents

Criteria	Cyanide	Thiourea	Thiosulphate	Aqua regia	Chloride	Iodide
Leaching Rate	Slow	Fast	Medium	Fast	Very fast	Very fast
Reagent Cost	Low	High	High	Low	Low	High
Corrosive	Non-corrosive	Non-corrosive	Non-corrosive	Very corrosive	Very corrosive	Non-corrosive
Toxicity	High toxicity	Less toxic	Less toxic	Less toxic	Less toxic	Non-toxic
Research Level	Extensive	Fairly popular	Extensive	Low	Extensive	Low

Table 2: Screening concept for leaching reagents

Criteria	Cyanide	Thiourea	Thiosulphate	Aqua regia	Chloride	Iodide
Leaching Rate	0	+	+	+	+	+
Reagent Cost	0	0	-	0	0	-
Corrosive	0	0	0	-	-	0
Toxicity	0	+	+	+	+	+
Research Level	0	0	0	-	0	0
Total Score	0	2	1	0	1	1
Rank	3	1	2	3	2	2

Note: [(+) = Better than], [(-) = Worse than] and [(0) = Same as].

Table 3: Scoring concept for leaching reagents

Criteria	Weightage (%)	Thiourea	Thiosulphate	Chloride	Iodide
Leaching Rate	20	5	4	5	5
Reagent Cost	25	3	3	3	3
Corrosive	20	3	3	1	3
Toxicity	25	3	3	2	5
Research Level	10	3	4	4	3
Total Score		3.4	3.3	2.85	3.9
Rank		2	3	4	1

Note: [(1) = Much worse], [(2) = Worse], [(3) = Same], [(4) = Better] and [(5) = Much better].

Conclusion:

In summary, to develop an environmentally friendly leaching method for recovery of precious metals from waste PCBs, environmental impact of leaching reagents should be paid more attention. Based on the screening and scoring method, a critical comparison of six leaching reagents is analyzed. Thiourea, thiosulphate and iodide leaching are more possible to replace cyanide leaching, as suggested by the result. From the comparison, it is clear that iodine leaching has higher advantages over the other two reagents due to highest score at screening and scoring method. Along with the further studies on this field, thiourea, thiosulphate and iodide leaching processes with potential environment benefits will become more economically feasible in the future.