RECYCLE & PRECIOUS METAL RECOVERY FROM DIFFERENT TYPES OF E-WASTE

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ABSTRACT:

For the quickly growth of population electrical and electronics equipment (EEE) waste are generated 20 to 50 million tones in world-wide. Half a tonne of e-waste generate by the resident of advanced country in every year. E-waste contains many types of toxic substances including metals, plastics and mercury etc which are hazardous or risky for the environment and human health so that E-waste management is an essential. Hence, this review are outline the global status of e-waste and its current progress on management of E waste (Electronics scraps) at worldwide level. An comprehensive survey of literature was made on the latest technological approaches in base metals recovery and so many technologies from waste printed circuit boards (PCBs) of EEE. An emphasis was given to review the most important features of existing industrial ways associated with the metal recovery systems from PCBs. The discussions of green technologies as alternatives of conventional approaches to obtain precious metals from e-waste were overviewed. The application of tin stripping method and recycling of E-waste approaches in the extraction metals from e-waste was highlighted.

Introduction:

Electronic scrap components, such as CPUs, contain potentially harmful materials such as lead, cadmium, beryllium, or brominated flame retardants. Recycling and disposal of e-waste may involve significant risk to health of workers and communities in developed countries

Electronic scrap components, such as CPUs, contain potentially harmful materials such as lead, cadmium, beryllium, or brominated flame retardants. Recycling and disposal of e-waste may involve significant risk to health of workers and communities in developed countries Electronic waste has been one of the fastest growing components of the municipal solid waste stream (Herat and Agamuthu, 2012). This is as a result of people enhancing their mobile phones, computers, and audio equipment’s (Jang, 2010). These are causing big issues as they are replaced most often (Herat and Agamuthu, 2012). Globally, it was projected that 3 billion electrical and electronic equipment will become electronic waste (e-waste) by 2010. In European countries, e-waste is predicted to grow 12 million tonnes by 2020 (United Nations University, 2007b). Developing countries are expected to generate twice as much as e-waste for the next 6-8 years as developed countries (Science Daily, 2010).

In addressing this growing issue, one of the most promising policy options is the Extended Producer Responsibility (EPR). The aim of EPR is to extend responsibility of the producer for their products until end of its useful life. The policy tool is an environmental protection strategy aiming to achieve the objective of a total decreased environmental impact of a product.
In view of benefits, recycling e-waste enables us to recover various valuable metals and other materials from electronics, saving natural resources (energy), reducing pollution, conserving landfill space, and creating jobs.

The report aims at providing research based evidence on the available technologies and the patenting trends in the area of electronic waste (E-waste) recycling and material recovery, while it is intended to provide background and supporting information to the Partnership for Action on Electronics Equipment under the Basel Convention and complement on Material Recovery and Recycling of End-of-Life Mobile Phones, CPU, Printed Circuit Board etc and the Guideline on Environmentally Sound Material Recovery.

Definition of E waste:

"E-waste" means "Waste Electrical and Electronic Equipment" ("WEEE") is a waste consisting of any broken or unwanted electrical or electronic appliance. It is a point of concern considering that many components of such equipment are considered toxic and are not biodegradable. Materials include in E-waste as under:

1. CPUs
2. Electrical typewriter
3. Printers
4. Telephones
5. Monitors
6. Refrigerators
7. Laptops
8. Air Conditioners
9. Mobile Phones
10. Printed Circuit Board
11. Cables
12. Washing Machine
13. Fluorescent and other Mercury containing lamps
14. And so many electrical items…..

Pollution:

The generated E-waste are collected by the local kabadivala, bhangarvala etc. and stored at open space. The kabadivalas and bhangavalas are disposed E-waste by Incinerated in open area. Due to open incineration of E-waste causes Air pollution, Water pollution, Soil Contamination etc.

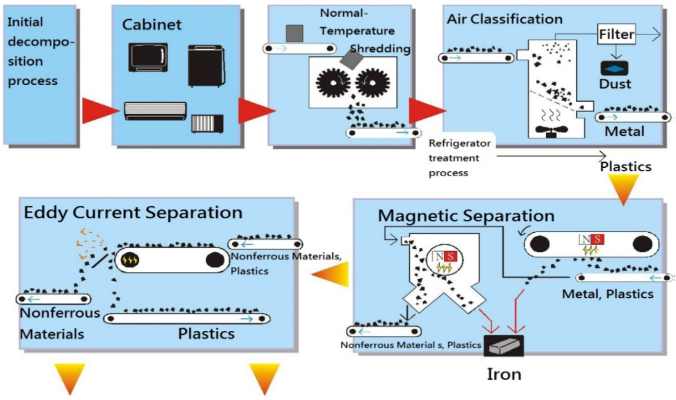
Due to open burning of E waste SO_2 NOx and many dangerous gas emitted so that the air pollution will be increase and chemicals like mercury, soldering material etc will contaminated with soil and water.

Simple Process Steps to recycle of E waste:

1. Collection of E-waste as per CPCB guideline
2. Safe storage as per CPCB guideline
3. Manual Dismantling and Segregation (Step -1)
4. Automated Segregation like compressor, TV tube etc. (Step -2)
5. Material Recovery (Step -3)

Primary stage E waste recycle:

In primary stage recycle of e waste we are recover plastic, iron, Non - ferrous metals which are easily separate with good quality and not required any chemical process. The process of primary stage separation as below:



Tin Recovery from Printed Circuit Board (PCB):

The steps wise process for Tin recovery as below:

<u>Prepare one liter of tin stripping formula:</u> 250ml/L of SnST-550A tin stripping agent was added to the solution of 68% 250 ml/L HNO3 and 500 ml/L water.
<u>Stripping process:</u> Printed circuit board were placed in the tin stripping solution, keeping the solution temperature at 40-45 C, and left to stand for 40 to 60 minutes, depending on the thickness of the tin.
<u>Remove related electronics components:</u> Such as capacitors and central processing units (CPUs), are removed by the reaction of the tin stripping agent in the solution.

<u>Sorting Process:</u> The sorting process will be used to separate the electronic parts with or without gold. The parts without gold will be sold or reused if they are still functioning while the gold-containing electronic components will be sent on to the electrolyte or chemical gold stripping process to separate the gold from the electronic parts.

<u>Purification process:</u> The stripping solution is then added NaOH to pH value >12; then the mud with the tin oxide is removed by filtering and the mud is placed through the 20% H2 and 80% N2 in a 700 C furnace such that a 99.96% pure tin product is formed in a high temperature environment.

Gold recovery from Printed Circuit Board (PCB)

The steps wise process for Gold recovery with chemical method as below:

Prepare the solution: The solution is prepared by adding the UW-860 gold stripping agent (500ml/L) to be formulated with 68% HNO3 solution (500ml/L).

Stripping process: The gold on the printed circuit boards or electronic parts are placed in a gold peeling solution while keeping the solution temperature at 40 C and left to stand for around 30 seconds to 1 minute, depending on the thickness of the gold content.

Collection: To extract gold, K2S is added to the remaining UW-860 fluid which produces a K2S gold mud. After filtering the gold mud, 68% HNO3 (300 ml/L) and H2O (700 ml/L) is added to get rid of copper and nickel impurities.

Purification process: After a water-based washing step, the gold mud is placed in a
1250 C high-temperature furnace in which 99.9% pure gold nuggets are produced.

The problem phasing in this process when wastewater arise owing to the addition of dilute HNO3 solution there are emitted the NOx gas.

Result:

In primary stage the material recovery from 1 tone of E waste as below:

Material Recovered	Weight (KG)
Copper	55
Plastic	480
Rubber	18
Glass	200
Iron	115

The Precious Metal of Tin & Gold Recovery from 1 KG of Printed Circuit Board (PCB) as below:

Precious Metal	Weight (Grams)
Tin	24.6
Gold	0.102
Total Recovery	24.702

Conclusion:

Printed circuit boards (PCBs) contains various valuable materials, such as copper, gold and silver, tin etc. From the economic point of view, recycling of those valuable materials is extremely attractive. Increasing generation of PCBs and the severe environmental impacts of landfills promote the development of recycling methodologies. The mechanical process is of importance for following chemical processes, because of the need for metal liberation. The Electrolyte process has been studied in terms of its advantages, such as low capital cost and less environmental impact. The work done shows the promising future in the world of PCBs recycling. Both Chemical and Electrolyte media have the potential for the extraction of base and precious metals. However, the flow sheets proposed are limited in lab-scale. Thus, larger scale studies should be concentrated on to achieve commercialization.

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