

ABSTRACT

Management of electrical and electronic waste (E-waste) is a global environmental challenge at this time. These wastes include mobile phones, computers, laptops, refrigerators, televisions and many other appliances. Metals, plastics, resins, ceramics and brominated flame retardants are present in E-waste. Most of these wastes (95%) are currently recycled by the informal sector in India without regard for their health, safety and the environment. The objective of this research was to evaluate the current status of e-waste management in the country and propose feasible solutions for existing problems. To this end, a survey was conducted of authorized (7) and unauthorized recycling facilities (3). Soil samples were collected from Sangrampur, West Bengal, India, that is well-known for its informal recycling activities and analysed for heavy metals (HMs) and polycyclic aromatic hydrocarbons (PAHs). Environmentally-safe hydrometallurgical processes were developed for recovering metals from printed circuit boards and mobile phone batteries. Health risks due to exposure to e-waste recycling activities or radiation from mobile phones and their batteries were assessed using standard USEPA methodology. HMs and PAHs were detected in soil samples from Sangrampur and compared with WHO guidelines. Epidemiological data for this area were obtained from the state government and analysed. It was found that the incidence of cancer in villagers involved in e-waste recycling activities was higher than in villagers not involved in these activities. In this study, two economically viable hydrometallurgical processes were developed by which 91% of the copper and Pb, Fe and Sn were recovered from printed circuit boards and 6 g of cobalt metal sheet along with copper, lithium, iron and manganese were recovered from lithium ion batteries. Radiation from mobile phones is another health concern as it can lead to permanent hearing loss or brain cancer. Radiation from active (15) and end-of-life mobile phones (10) and lithium-ion batteries (10) was measured using a Geiger-Muller counter. Many phones and batteries (92.60%, 88.48%, respectively) were found to emit radiation at higher levels compared to the background which implies that storing these e-waste in homes and throwing in the environment would cause serious health hazards and also affects the ecosystem.

Keywords – printed circuit boards, lithium ion batteries, metal recovery, carcinogen, polycyclic aromatic hydrocarbon.