E-WASTE MANAGEMENT REUSE AND RECYCLE

Submitted in partial fulfilment of the requirements
of the degree of Bachelor of Engineering

by

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2019

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2018-2019

CERTIFICATE

This is to certify that the project entitled "E-Waste Management Reuse and Recycle" is a bonafide work of Shaikh Noor Mohd Rafique Ahmed (16DCES86), Nadaf Moulali Hussain (16DCES79), Mulla Kamran Faisal (16DCES77), Sangade Navman Bashir (14CES39) submitted to the University of Mumbai in partial fulfilment of the requirement for the award of the degree of "Bachelor of Engineering" in Department of Civil Engineering.

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PROJECT REPORT APPROVAL FOR B. E.

This project report entitled "**E-Waste Management Reuse and Recycle**" by Shaikh Noor Mohd Rafique Ahmed (16DCES86), Nadaf Moulali Hussain (16DCES79), Mulla Kamran Faisal (16DCES77), Sangade Navman Bashir (14CES39) approved for the degree of "Bachelor of Engineering" in "Department of Civil Engineering".

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DECLARATION

We declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. We also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ACKNOWLEDGEMENT

It is our privilege to express our sincerest regards to our project Guide**, Dr. Shabiimam M.A.**, for their valuable inputs, able guidance, encouragement, whole-hearted cooperation and constructive criticism throughout the duration of our project.

We deeply express our sincere thanks to our Head of Department **Dr.R.B.Magar** and our Director **Dr. Abdul Razzak Honnutagi** for encouraging and allowing us to present the project on the topic "**E-waste Management Reuse and Recycle**" in partial fulfillment of the requirements leading to award of Bachelor of Engineering degree.

We take this opportunity to thank all our Professors and non-teaching staff who have directly or indirectly helped our project, we pay our respects and love to our parents and all other family members for their love and encouragement throughout our career. Last but not the least we express our thanks to our friends for their cooperation and support.

ABSTRACT

E-waste are the electronic products which have been discarded by their owners after end of life. It consist of materials like as computer, keyboard, bulbs, wires, batteries, etc. E-waste contains hazardous materials such as lead, mercury, chromium in circuit board .Therefore it is necessary to manage the e-waste properly and recycled. The study review on recovery of copper from PCB board by using different acid waste , printed circuit board cut into small pieces and then washed it by using this different acid such as sulphuric acid , hydrochloric acid and nitric acid prepare the acid solution by using the acid recovery of copper is done . From the study it is observe that by using sulphuric acid($2.18h_2SO_4$) higher amount of copper can be recover compare to other acid .E-waste can be used as a replacement of fine aggregate in concrete . They give the light weight concrete and good strength.

Keywords:-E-waste, PCB, Recycling, Recovery of Metal, E-waste use in concrete.

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ABBREVIATION NOTATION AND NOMENCLATURE

E-Waste – Electronic Waste

Cu – Copper

H_2SO_4 – Sulphuric acid

HCL – Hydrochloric acid

HNO_3 – Nitric acid

Chapter 1

Introduction

1.1 Introduction

E-waste are the electronic products which have been discarded elements or products such as computer, mobiles, phones, bulbs, batteries, printer machines, fax machines, etc. Due to development of new technology and replacement of new modified models are increase the growth of E-waste. It estimated in India produced 2 million tons of e-waste at every year and e-waste consist of various hazardous elements such as lead, chromium, mercury, cadmium and plastic they are very harmful to human health and environment. In India 95% of e-waste produced by informal sector they do not take the proper precautions during handling of e-waste due to which causes various diseases. E-waste consist of valuable metal or element it can be reuse when proper treatment method is adopted. The purpose of this research to understand, identify and amplify in depth knowledge about e-waste management and also focus on their disposal of end of life appliance.

Electronic waste or E-waste is relatively a novel addition to the ever-growing hazardous waste stream. It includes discarded electronic and electrical equipment. Developing countries are facing enormous challenges related to the generation and management of E-waste which are either internally generated or imported illegally; India is no exception to it. However, the existing management practices related to E-waste in India are reasonably poor and have the potential to risk both human health and the environment. Moreover, the policy level initiatives are not being implemented in an appropriate way. The austere problem of E-waste

along with its policy level implications is looked upon in the paper. During the course of the study it has been found that there is an urgent need to address the issues related to E-waste in India in order to avoid its detrimental future consequences.

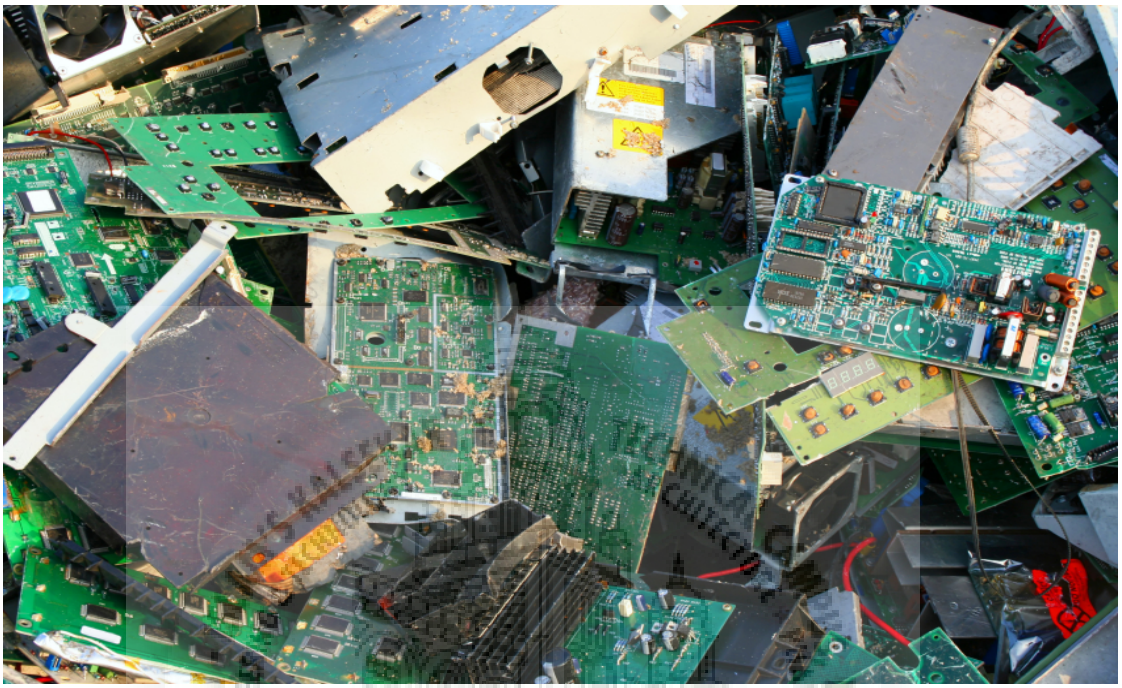

Figure 1.1 E-waste

1.2 Generation and Collection of E-waste

The main sources for the generation of e-wastes are the IT sectors, government sectors, educational institutions, commercial sectors, household and manufacturing sectors. These sectors transport their e-wastes to the formal and informal sectors as per their benefits. There are 95% informal sectors and only 5% formal sectors present in the country but most of them are dismantlers. Accurate data for the generation of e-wastes are not been cleared due to the illegal import business of e-wastes from the developed countries like USA and EU. In recent time, the informal sectors with the illiterate people are dominating over the formal sectors and are treating e-wastes in a dangerous manner which causing pollution and harm to the human health and environment

Figure 1.2 E-waste Source

In India there is no separate collection of E-waste and there is no clear data on the quantity generated and disposal of each year and resulting extent of environment risk. Electronic items in India is to get them exchange from retailers when purchasing a new item. In India, E-waste is covered in Schedule 3 of "The Hazardous Waste Rules, 2003". Under Schedule 3, E-waste defined as "Waste Electrical and Electronic Equipment including all components, sub-assemblies and their fractions except batteries falling under these rules". According to the very recent "the e-waste Rules, 2011", electrical and electronic equipment which is dependent on electrical currents or electro-magnetic fields to be fully functional, whole or in part or rejects from their manufacturing and repair process, which are intended to be discarded. It is review from the Electronic waste in India: Problems and policies in 2012 by Anwesha Borthakur and Pradeep Singh in Gujrat, India

Table 1.1: Top five E-waste producing states in India

State	E-waste in MT
Maharashtra	20270
Tamil Nadu	13486
Andhra Pradesh	12780
Uttar Pradesh	10381
West Bengal	10059

There is no large scale organized E- waste recycling facility in India and the entire recycling exists in unorganized sector. Expert reported waste glass can be used by grinding it into a fine glass powder (GLP) for incorporation into concrete as a pozzalanic material. It under goes beneficial pozzalanic reactions in the concrete and could replace up to 30% cement in some concrete mixes with satisfactory strength development. P.M. Subramanian described the need for an integrated waste management approach to be considered involving efficient use of plastic materials, recycling and disposal mechanisms. The amounts of plastics consumed annually in the growing tend of Indian and US scenario was discussed. The possibilities of a comprehensive investigation of the technical economic and ecological aspects of recycling were addressed by the author. Reviewed glass chemistry, alkali silica reaction mechanism, expansion of concrete containing glass aggregates and micro structure of the interfacial transitional zone between cement paste and glass particles. It has been noticed that the mechanism of expansion of concrete caused by glass aggregate is different from that by traditional ASR expansion. It was conferred that the expansion of concrete containing glass aggregate reacts with alkalis in the cement to from alkali silicate or NCSH which absorbs water and cause expansion. The author suggested that it is necessary to control the pH of the concrete under 12 in order to avoid deleterious expansion and cracking of concrete containing large glass particles.

1.3 Health and Environmental Impact of E-waste

Adverse health effects on people from contact with hazardous waste may involve any organ system, depending on the specific chemical contacted, the extent of exposure, characteristics of the exposed individuals like age, body weight, immunological status and the metabolism of the chemicals involved, weather condition, and the presence or absence of confounding variables such as other dieses. Electronic wastes can cause widespread environment damage due to the use of toxic materials in the manufacture of electronic. There are various effects of e-waste constituent on health as well as environment such as Lead (Pb), Cadmium (Cd), Mercury (Hg), Plastic, Barium (Ba), Beryllium (Be), etc. E-waste are hazardous and arises due to improper recycling and disposal processes and that are increasing in developing countries including India. Whereas e-waste are recycled or burnt. The disposal of e-waste is major problem in regions occurs across the global, e-waste are produced contaminated leachates which pollute the ground water system. Acids and sludge's are obtained from melting of computers chips if they are

disposal on ground it causes acidification of soil and it also produced water shortage due to contamination of water resources. Incineration of e-waste causes another threats to toxic fumes and gases and polluting the surrounding air.

Table 1.2: Metals present in various electronic products and their effects on human health

Metals present	Occurrence in e-products	Effect on human health
Cu	Copper wires , Printed circuit boards , coils , conducted in cables	Damages the liver and kidney and even causes health
Pb	Soldering agent , lead rechargeable batteries , gaskets in computers monitors , transistors , lasers , thermoelectric elements	Affects the brain development in children , cause damage in kidney , central and peripheral nervous system
Hg	Relays and switches , LCDs , pocket calculators	Damages the respiratory system , brain and causes skin problems
Cd	Printed circuit boards , computer batteries and cathode ray tubes	Affects the neural health , accumulates in liver and kidney and have teratogenic effect
BFRs	Circuit boards , casing , cables and PVC cables	Damages endocrine system
PCBs	Transformers , capacitors	Cause cancer , effects on the immune system ,reproductive system , nervous system , endocrine system and others
Plastics & PVC	Cables and body parts of e products	Incineration generates toxic gases like dioxins which damages the immune system , causes reproductive problem , and interferes with regulatory hormones

1.4 Aim

To recover the copper from pcb boards by using different acid and use the e waste in concrete.

1.5 Objective

1. To analyse the characteristics of e waste
2. To segregate e waste properly
3. To reuse the segregated e-waste

4. To recover the valuable metals such as copper by using various acid such as sulphuric acid, nitric acid, etc.
5. Replacement of e-waste as fine aggregate in concrete

Chapter 2

Literature Review

Ashwini Manjunath B T (2015) An experimental study is made on the utilization of E-waste particles as fine and coarse aggregates in concrete with a percentage replacement ranging from 0 %, 20% to 30% i.e. (0%, 10%, 20% and 30%) on the strength criteria of M20 Concrete. Compressive strength, Tensile strength and Flexural strength Concrete with and without E-waste plastic as aggregates was observed which exhibits a good strength. The feasibility of utilizing E-waste plastic particles as partial replacement of coarse aggregate has been presented. In the present study, compressive strength was investigated for Optimum Cement Content and 10% E-plastic content in mix yielded stability and very good in compressive strength of 53 grade cement. This study was designed to treatment of textile waste water using the electro-coagulation process. In this system two type of flow regimes are used semi-continuous flow regime. have been altered to investigate the effects of COD & dye stuff removal. In this study the COD removal & dye removal achieve a greater value . The inlet COD concentration was 1953 mg/l was reduced to 30 mg/l at current density of 20 mA/cm^2 and retention time of 60min. The dye removal was about 93% thus the experiment shows great potential to treat the textile waste water.

L. A. Castro and A. H. Martins (2009):- This paper presents the experimental results for the leaching of printed circuit boards (PCB) from obsolete computers for extracting and recovering tin and copper by means of leaching followed byprecipitation. Printed circuit boards were dis mantled, cut into small pieces, and fed into a cylinder mill. The powder obtained was leached by using the aqueous solutions 2.18N H2SO4, 2.18N H2SO4 + 3.0N HCl, 3.0N HCl, and 3.0N HCl + 1.0N HNO3. The lowest values for the percentage of metal extraction were obtained

with 2.18N H2SO4 (2.7% for Sn and lower than 0.01% for Cu), while the 3.0N HCl + 1.0N HNO3 leach system exhibited an extraction of 98% for Sn and 93% for Cu. Precipitates were obtained at different pH values by neutralizing the leach liquors using NaOH. The 3.0N HCl + 1.0N HNO3 leach system presented the highest recovery values from the powder feed (84.1% for Sn and 31.9% for Cu)

Amiya Akram, C. Sasidhar (2015):- It was observed that when e-plastic alone was used , it resulted in decrease in strength but when 10% fly ash was added results comparable to control specimen were obtained even for 15% proportion of e-waste. Replacement of this waste in will reduce the requirement for conventional coarse aggregates thereby resulting in conservation of natural resources. The specific gravity of e-plastics is much less, if used in concrete, they can reduce self-weight of the mix The best way to manage increasing amount of e-plastic waste is integration of multiple options for handling plastics from end-of-life electronics. This approach includes varying combinations of mechanical recycling, feedstock (or chemical) recycling, reuse, energy recovery, and when necessary, the safe landfilling of plastics. All these options can be viable for managing e-plastic. However, the optimal combination of management options in any particular region depends on the resources, technologies and availability of materials.

Priya Gautam , Prof. Ashok K Sharma **(2018):-** In this paper mechanically pre- treated PCBs are leached with HCl and HNO3 acidic solution and the distribution of the metals fraction were determined by using Atomic Absorption spectrophotometer analyses. It is found that the availability of copper in the sample is highest as compare to other metals. Experimental results also shows that leach liquor of concentration 3N HNO3 was most efficient to recover metals. After leaching of metals dissolved solution is taken for the final recovery of metals.

Mark Y.L. Wang, Markus A. Reuter (2014) This paper investigates the collection channels of waste electrical and electronic equipment (WEEE or e-waste) and household recycling behaviours in Taizhou city of China. Taking a questionnaire survey as the main approach, it explores the household generation of eighteen types of e-wastes and analyses the distribution of six disposal alternatives. Besides, it also assesses the determinants of choosing collection channels and evaluates households' attitudes in voluntary return of e-waste. The study found that informal collection is the primary disposal channel of urban household e-waste. A considerable proportion of the obsolete appliances are stored at home, given to others, or

discarded, but the amount of e-waste flowing to formal collectors remains small. Compared with formal counterparts, informal collectors are advantageous in the aspects of collection scope, convenience of service, flexibility.

Bharat Dawande1 Devansh Jain (2016) The present study covers the use or recycled e-wastes as replacement of coarse aggregates in concrete. The main aim of the study is to investigate the change in properties of concrete with the addition of e-wastes in concrete. It is found that the use of e-waste aggregates results in the formation of lightweight concrete. In this dissertation coarse aggregate is partially replaced by coarse aggregate up to 25% with regular interval /of 5%,along with fly ash partially replacing cement in concrete of grade M40 and properties like workability, compressive strength and flexural strength is evaluated

Chapter 3

Materials and Methodology

3.1 General

The main objective of this study is to recover the copper from waste PCB boards using different acid.

3.2 Material and Chemicals

- Waste PCB Boards
- Sulphuric Acid (H_2SO_4)
- Hydrochloric Acid (HCL)
- Nitric Acid (HNO_3)

3.3 Collection of Materials

E-waste is collected from our college AIKTC and nearby area such as PC Board, TV Remote, and Motherboard etc.

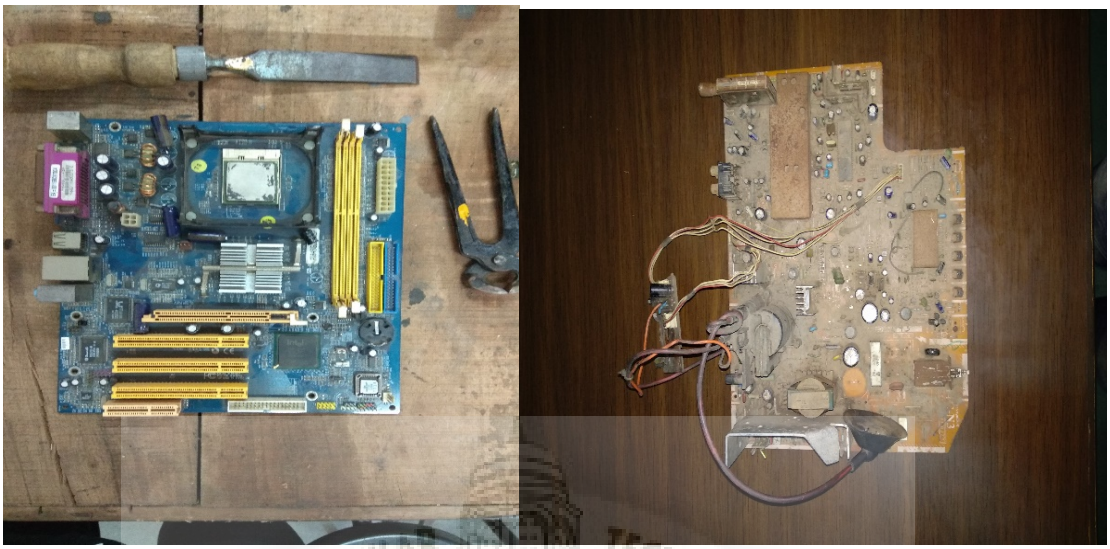

Figure 3.1 Waste PCB Boards

Figure 3.2 Segregation of E-waste

3.4 Methodology

The waste PCB of a discarded computer used in study. It is commonly used PCB that can be easily available at the e- waste disposal area or an electronic shops and AIKTC college. Various components like RAM, ICs etc are attached on PCB were first removed manually from it. Then Chemical coating of epoxy resin present on PCB was removed by using NaoH because the covering of this coating does not allow the leaching agent to penetrate through it. For the

recovery of metals, waste PCB were cut into small pieces in different sizes instead of powder form. About 10gms of PCB sample was allowed to react with the 100ml of leach solution of 3N HCL/HNO3. The experiment was carried out at 60 C for 1hr.The leach liquor sample was collected, filtered and sent for chemical analysis

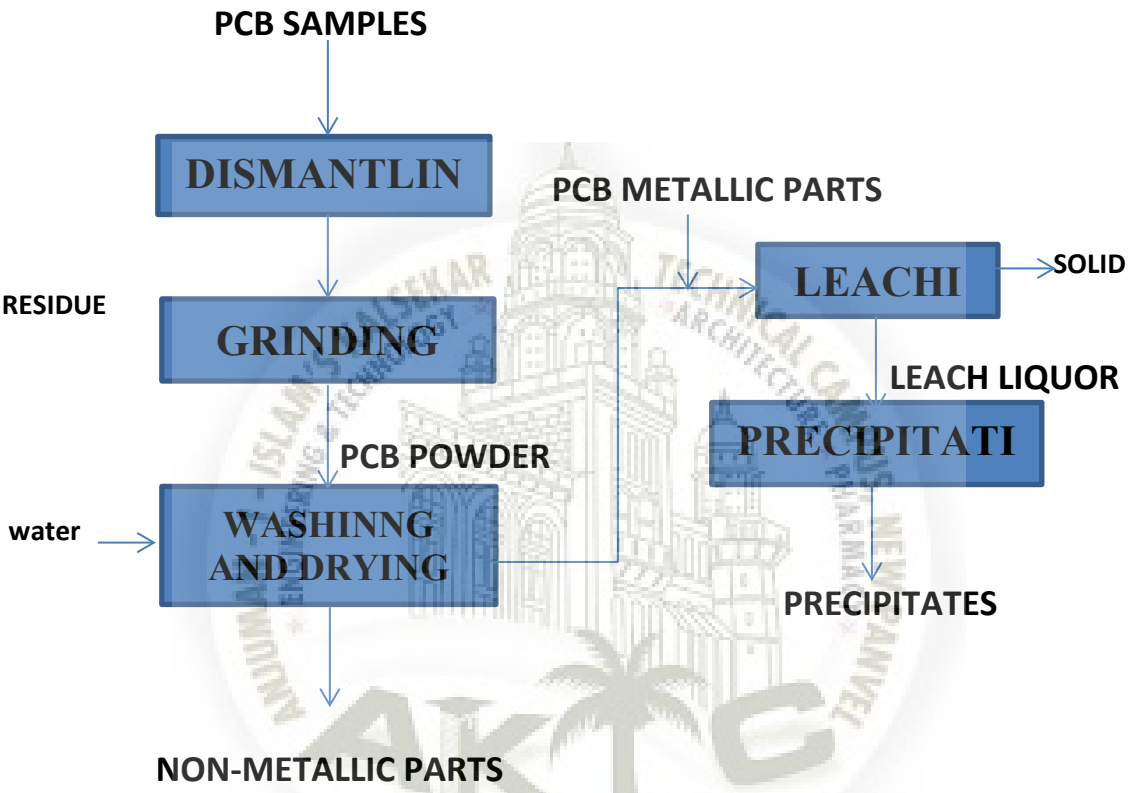

Figure 3.3 block diagram of the process

Figure 3.4 Magnetic stirrer

Figure 3.5 Testing on sample

3.5 E-Waste use in Concrete

3.5.1 Cement

Ordinary Portland cement of 53 grades availabusele in local market is used in the investigation. The cement has been tested for various proportion as per IS 4031-1988. The specific gravity was 2.96 & fineness was 3200 cm^2/gm.

3.5.2 Course Aggregate

Crush angular metal of 20 mm size from a local source was used as course aggregate. The specific gravity of 2.71 & fineness modulus 7.31 was used.

3.5.3 Fine Aggregate

River send was used as a fine aggregate. The specific gravity of 2.60 & fineness modulus 3.25 was used in the investigation.

3.5.4 E- waste

Usually E- waste from electrical & electronic equipment's such as computer, TV, Refrigerator, A.C., radio etc. E- waste are crush into small pieces

3.5.5 Mix Proportion

The concrete mix is designed as per the guidelines given in the various Indian standard namely IS 10262-1982, IS 456-2000 for M 20 grade. The water cement ratio was maintain as per required proportion of 1:1.5:3.

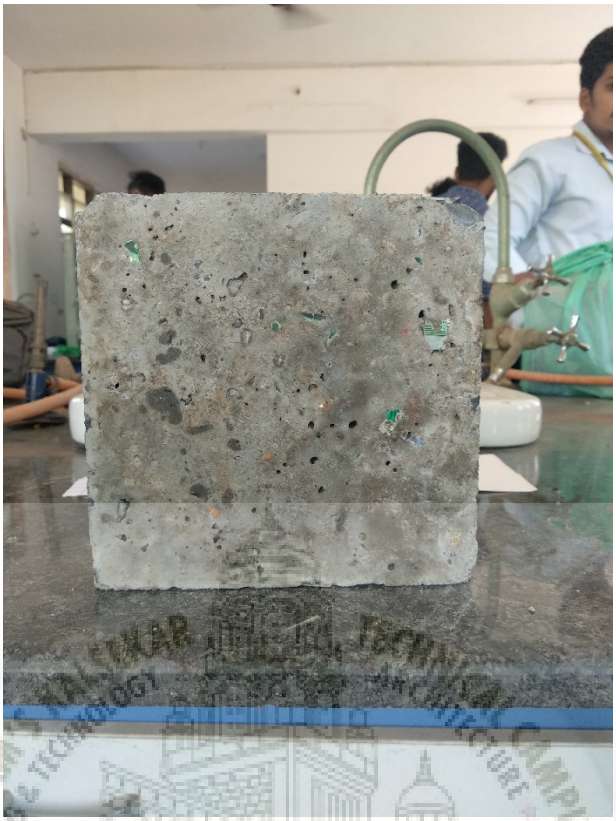

Figure 3.6 E-waste Block

Figure 3.7 Experimental set up CTM

Chapter 4

Result and Discussion

4.1 General

This chapter discuss about the results and discussion based on the experimental study conducted.

4.2 Recovery of copper by using Sulphuric acid (H_2SO_4)

From table (4.2) and fig no (4.2) it is observe that more copper is recover at heating of 60 min i.e 71.6 gm and less copper is recover at heating of 10min i.e. 22.86 gm . By using H_2SO_4 more copper is recover as compared to other acid.

Table 4.1 Recovery of Copper using Sulphuric acid (2.18 H_2SO_4)

Time	Cu g/kg
10	22.866666
20	26.333333
30	34.333333
40	46.266666
50	70.2
60	71.666666

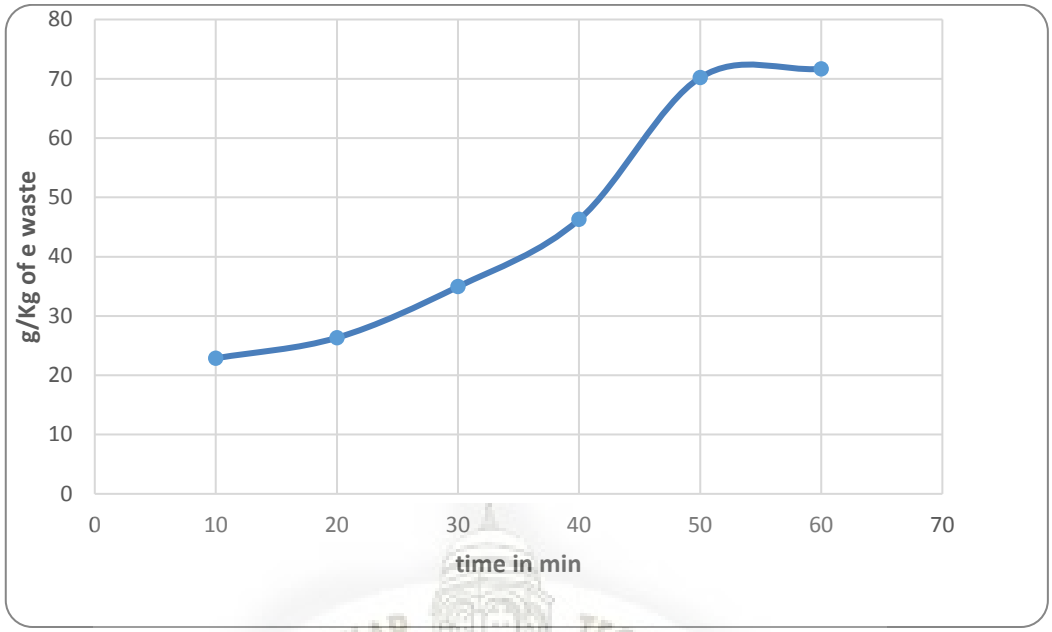

Figure 4.1 Recovery of Copper using Sulphuric acid (2.18 H_2SO_4)

4.3 Recovery of Copper by using Hydrochloric Acid (3N HCL)

From table (4.3) and fig no (4.3) it is observe that more copper is recover at heating of 50 min i.e 32.4 gm and less copper is recover at heating of 10min i.e 3.133 gm .

Table 4.2 Recovery of copper using Hydrochloric acid (3N HCL)

TIME	Cu g/kg
10	3.1333333
20	0.8
30	0.5333333
40	6.0666666
50	32.4
60	33

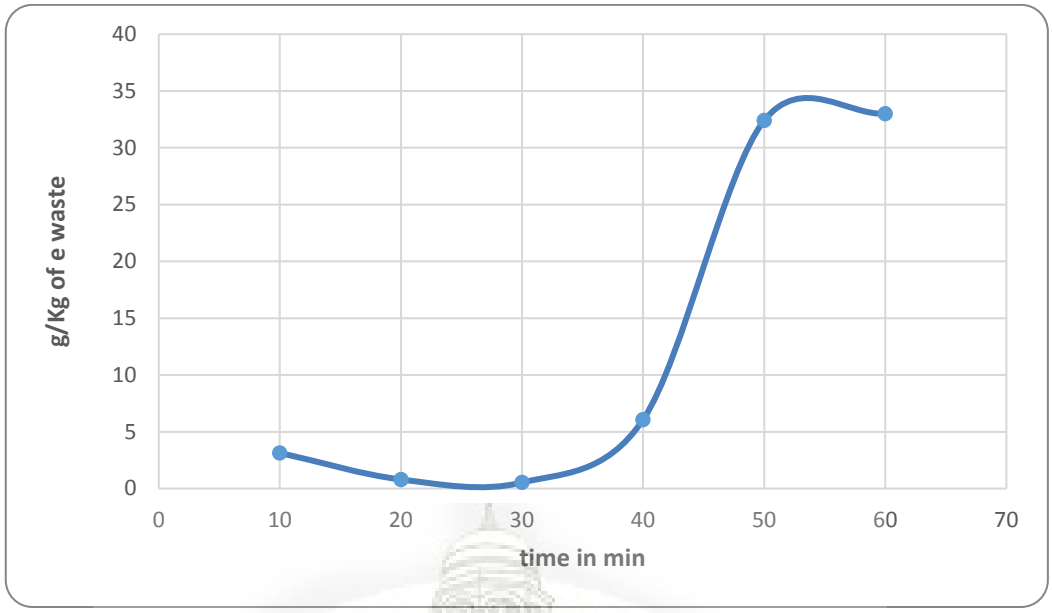

Figure 4.2 Recovery of copper using Hydrochloric acid (3N HCL)

4.4 Recovery of Copper by using Sulphuric acid +Hydrochloric acid ($2.18H_2SO_4$+3NHCL)

From table (4.4) and fig no (4.4) it is observe that more copper is recover at heating of 50 min i.e 7.133 gm and less copper is recover at heating of 10min i.e 10.33 gm .

Figure 4.3 Recovery of copper using sulphuric acid +hydrochloric acid ($2.18H_2SO_4$+3NHCL)

TIME	Cu g/kg
10	10.3333333
20	5.13333333
30	7.26666666
40	1.46666666
50	7.13333333
60	16.2666666

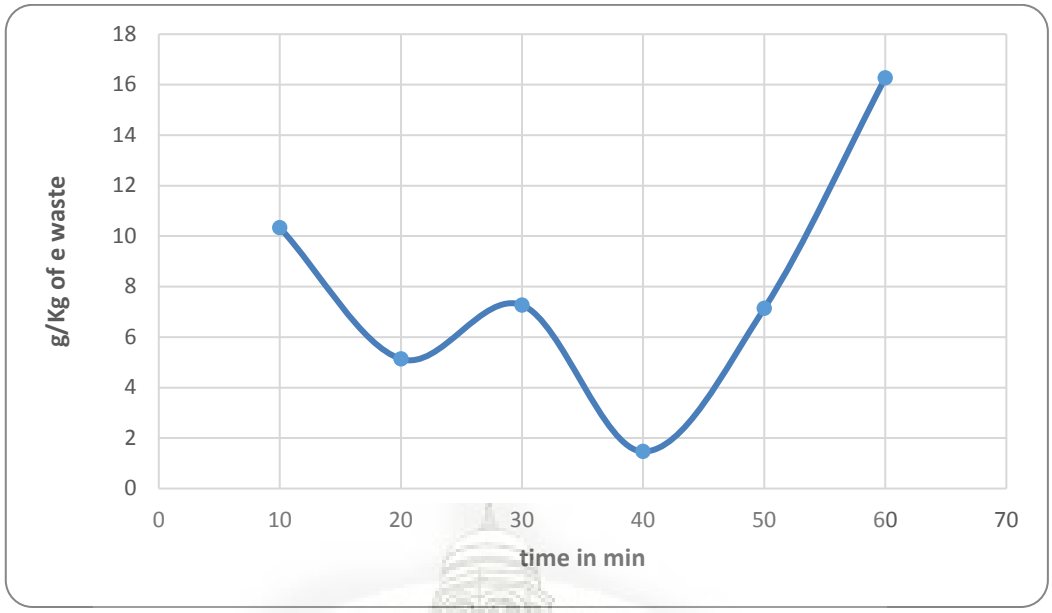

Figure 4.4 Recovery of copper using sulphuric acid +hydrochloric acid (2.18H_2SO_4+3NHCL)

4.5 Recovery of copper using Hydrochloric acid +Nitric acid (3NHCL + 1$NHNO_3$)

From table (4.5) and fig no (4.5) it is observe that more copper is recover at heating of 50 min i.e 39.06 gm and less copper is recover at heating of 10min i.e 3.6 gm .

Table 4.3 Recovery of copper using Hydrochloric acid +Nitric acid (3NHCL + 1$NHNO_3$)

TIME	Cu g/kg
10	3.6
20	8.466666667
30	14.86666667
40	15.93333333
50	21.8
60	39.06666667

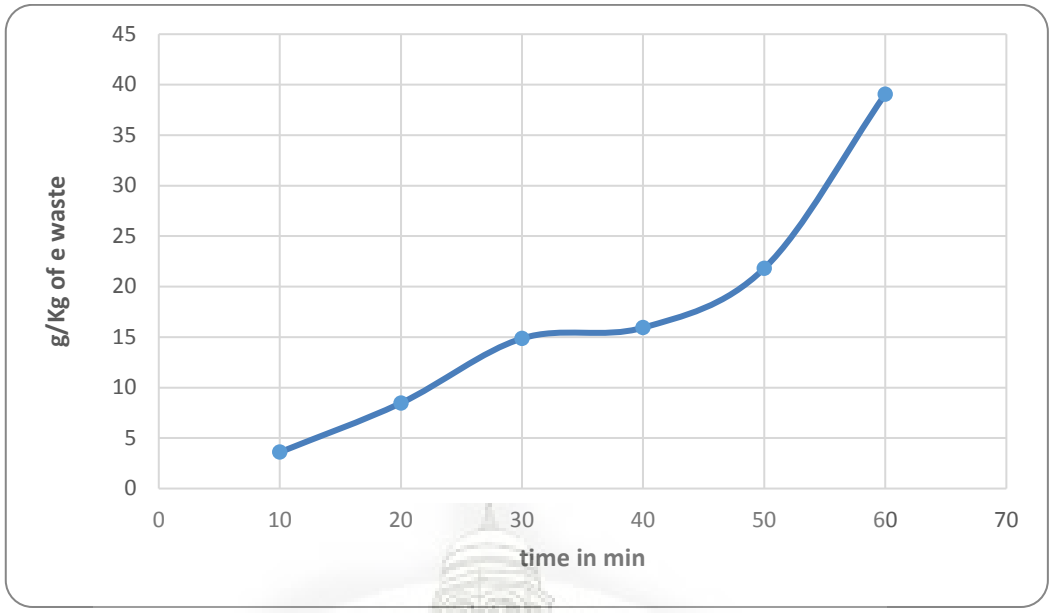

Figure 4.5 Recovery of copper using Hydrochloric acid +Nitric acid (3NHCL + 1NHNO3)

4.6 Use of E-waste in concrete

Figure 4.6 Compressive Strength of Block

Table 4.4 Compressive strength of cube with E-waste in Mpa

Sample	7 days	14 days
Sample no 1	18.6 Mpa	26.8 Mpa
Sample no 2	18.9 Mpa	27.1 Mpa

Chapter 5

Conclusion

According to the experimental results, we can concluded that:

1. Utilization of patial replacement of E–waste as a coarse aggregate is the best alternative for the conventional concrete.

2. The disposal of E–waste can be used as a coarse aggregate provides the reduction in burden on landfill disposing and environmental pollution.

3. The E–waste concrete density is less as compared with the conventional concrete which reduces the cost of the concrete and produces the light weight concrete structure

4. - waste is one of the most hazardous waste which growing rapidly. If it is not regulated properly may be proved to be dangerous not only for humans but also for the environment. The main purpose of recycling PCB waste is to reduce the harmful effects cause due to hazardous material present in it and ensure maximum recycling. Selection of efficient recycling method is required to achieve these goal.

5. The result shows that the recovery of large pieces of PCB sample is efficiently recovered. The use of large pieces of PCB will facilitate the recycling of remaining board. Basic and most effective way to reduce the problem of generating e-waste is 3 R's. They are REDUCE, REUSE & RECYCLE. With the help of this 3R's minimize the impact of hazardous component present in the environment. Strict rules & regulations

and public awareness should be implemented regarding e -waste. Adopted Economic, efficient and sustainable concept of e-waste management system.

REFERENCES

1. Dutta, D. Geol, S. Hait, J and Jha, M. K. (2017). *E-waste generation, Management, Utilization and Recycling: A Review Metallurgy and Materials Science*, Vol. 58, No. 3, (2016), pp. 89-98.

2. Borthakur, A. Singh, P. (2012). *Electronic waste in India: Problems and policies*, International Journal of Environmental Science, Volume 3, No 1, 2012, Gandhinagar, Gujrat, India.

3. M.D.Jalal Uddin, (2012). Journal And Conference Paper, *E-waste Management*, ISSN: 2278-1684 Volume 2, Issue 1 (July-Aug 2012), PP 25-45.

4. Joseph, K. (2007). *Electronic Waste Management in India-Issue and Strategies*, Proceedings Sardinia 2007, Eleventh International Waste Management and Landfills Symposium S. Margherita di Pula, Cagliari, Italy: 1-5 October 2007, Centre for Environmental Studies, Anna University, Chennai, India.

5. Priya Gautam , Prof. Ashok K Sharma , Prof. Sarita Sharma (2018) Extraction of Metals From The Discarded Printed Circuit Board by Leaching, Volume: 05 Issue: 01 | Jan-2018, Department of Chemical Engineering, Ujjain Engineering College, Ujjain (M.P) India.

6. Jha M.K., Kumar A., Kumar V. and Lee J.C., (2011), Prospective scenario of e-waste recycling in India. In proceeding of Second Symposium on Recycling of Electronic Waste II, 2011, Recycling of waste II.

7. Jayapradha A., (2015), Scenario of E-waste in India and application of new recycling approaches for E-waste management. Journal of Chemical and Pharmaceutical Research, **7**(3), pp. 232-238.

8. Widmer R., Oswald-Krapf H., Sinha-Khetriwal D., Schnellmann M. and Boni H., (2005), Global perspectives on e-waste. Environmental ImpactAssessment Review, **25**, pp. 436-58.

9. Kumar R. and Karishma, (2016), Current scenario of e-waste management in India: issues and strategies. International journal of scientific and research publications, **6**(1). United Nations University 2014 The Global e-waste monitor. Quantities flows and resources.

10. Bandhopadhyay, A. (2010) "Electronic Waste Management: Indian Practices and Guidelines" International Journal of Energy and Environment 1(5) pp. 193-807

LIST OF PUBLICATIONS

PROJECT EXHIBITION

- Participated in 5th National level project exhibition Cum Poster and Paper Presentation at Universal College of Engineering, Vasai.

- Participated in National level project exhibition Cum Poster And Paper Presentation at Viva Institute Of technology ,Virar