



WHZ Westsächsische
Hochschule Zwickau
Hochschule für Mobilität



E-WASTE RECYCLING

Course: Global business and project communication in English



Presented To
Prof. Busch- Lauer

Presented By
Syedah Zahra Alavi
48840

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Introduction

WHAT IS E-WASTE?

E-waste, or **electronic waste**, refers to **discarded electrical** or **electronic devices** that have reached the end of their useful life.

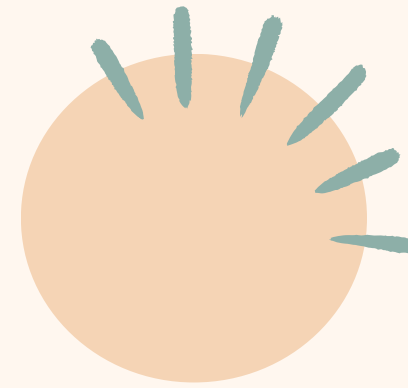
Smartphones, Computers, Calculators, lamps, smartwatches

WHY DOES RECYCLING E-WASTE MATTER?

1. E-waste is the **fastest** growing **solid waste** in the world
2. Each year, **over 50 million tonnes** of e-waste are produced
3. only **17 %** of e-waste is properly recycled
4. causing detrimental **environmental** and **economic, social** effects



HOW TO DISPOSE OF E-WASTE AT HOME?



01

Understanding What is E-Waste

02

Reduce Your E-Waste

03

Recycle

04

E-Waste Recycling Centres

05

Donate or Sell Functioning Devices

06

Try Manufacturer Take-Back Programs

07

Dispose Batteries Separately

08

Certified E-Waste Recyclers(**R2** or **e-Stewards**)

09

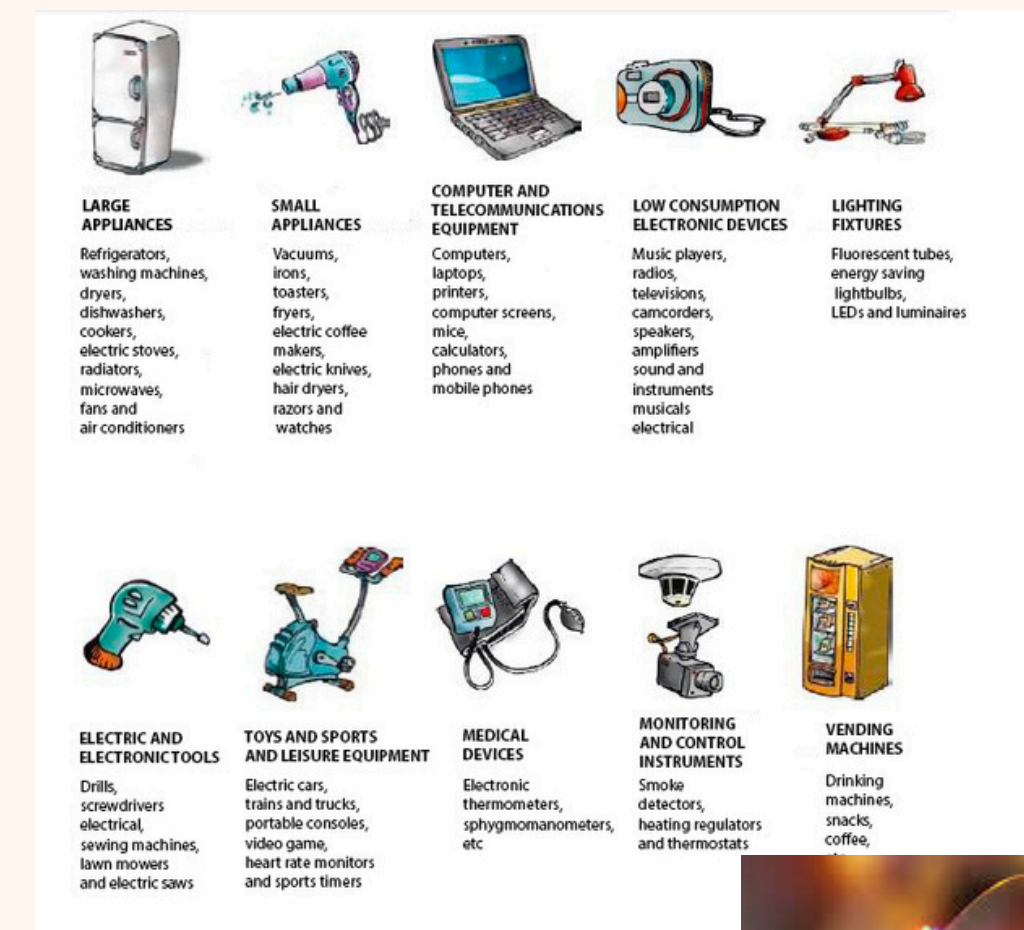
Educate Your Office or Household

10

Upcycle or Be Creative

11

Secure Data Before Disposal, Sale, or Donation



CHALLENGES IN RECYCLING E-WASTE



1. Complexity and diversity of materials:



1. mix of **valuable materials** like gold, silver, and copper, as well as **hazardous substances** like lead and mercury
2. Separating them is **technically challenging** and **expensive**

2. Rapid technological evolution:



1. New gadgets keep coming, making e-waste **different** and **difficult** to standardize **recycling processes**
2. Because old stuff becomes **useless** fast, there is always **new e-waste**

3. Collection and logistics:



Limited **access** to **recycling facilities** and unreliable **collection services** in some areas pose physical barriers to e-waste recycling

4. Lack of regulations and enforcement:



1. Many countries still **lack** comprehensive **legislation** and **regulations** around e-waste management and recycling
2. Even where regulations **exist**, their effective **implementation** and **enforcement** remain a **challenge**

5. Consumer awareness and behavior:



1. Lots of people do not know much about recycling electronics
2. Sometimes, people just **forget** or find it too **much trouble** to recycle

6. Hazardous material handling:



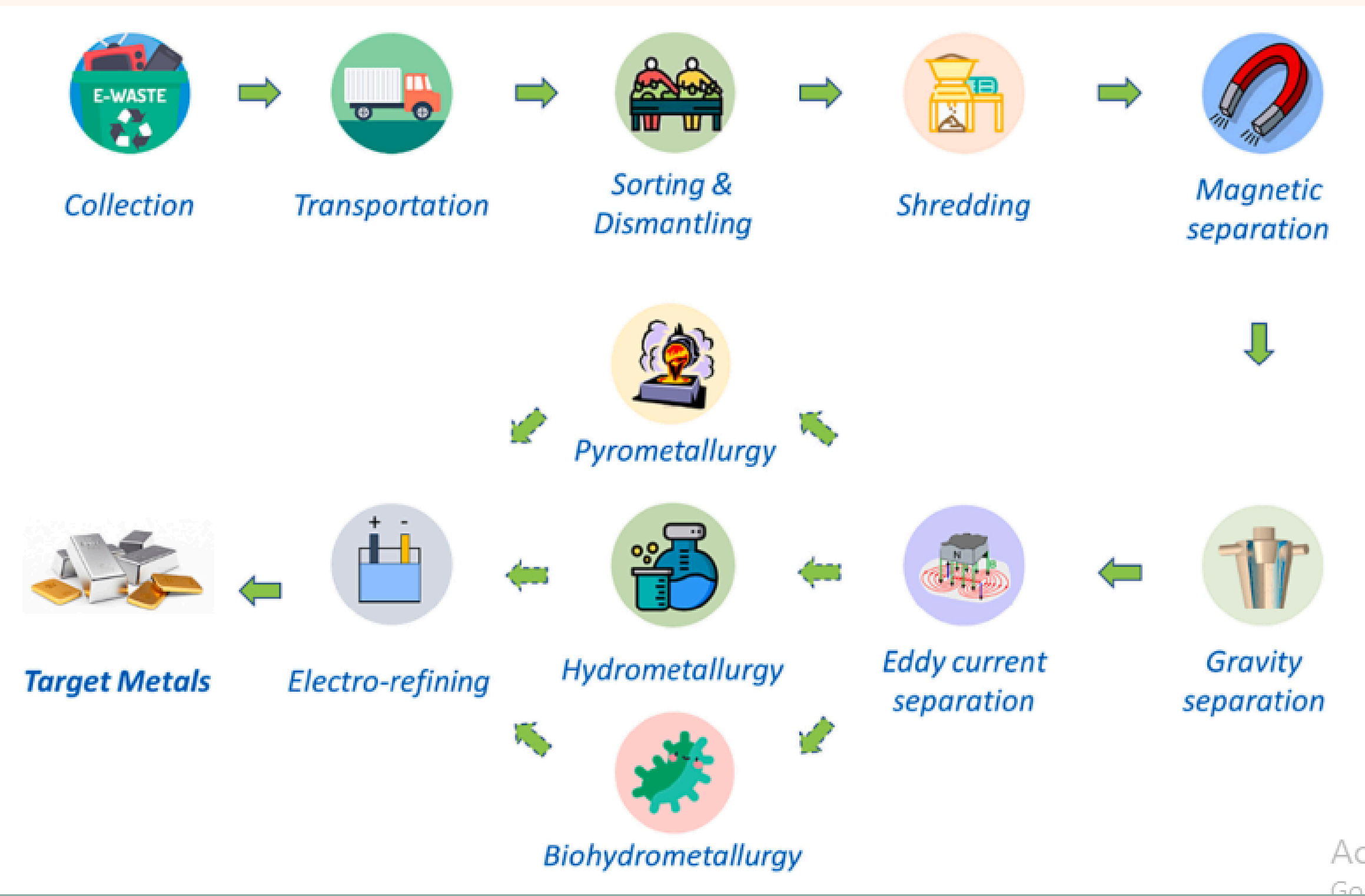
The **toxic substances** in e-waste require **specialized equipment** and **expertise** to handle safely, which can be **costly**



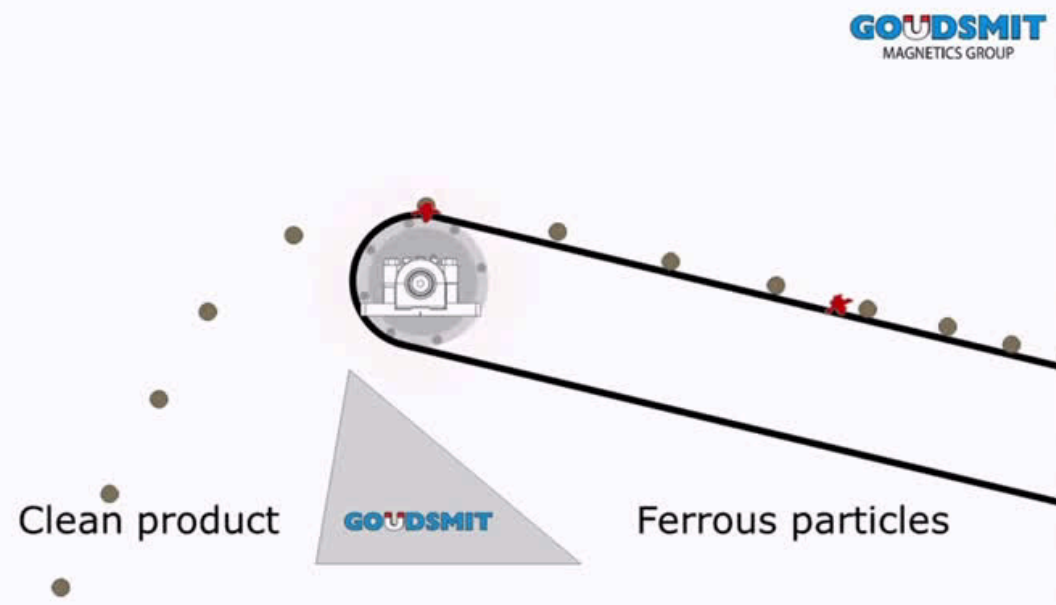
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2. <https://link.springer.com/article/10.1007/s13762-022-04274-w>
3. <https://www.ewaste1.com/top-barriers-to-e-waste-recycling/>
4. <https://techreset.com/itad-guides/why-is-recycling-e-waste-so-difficult/>

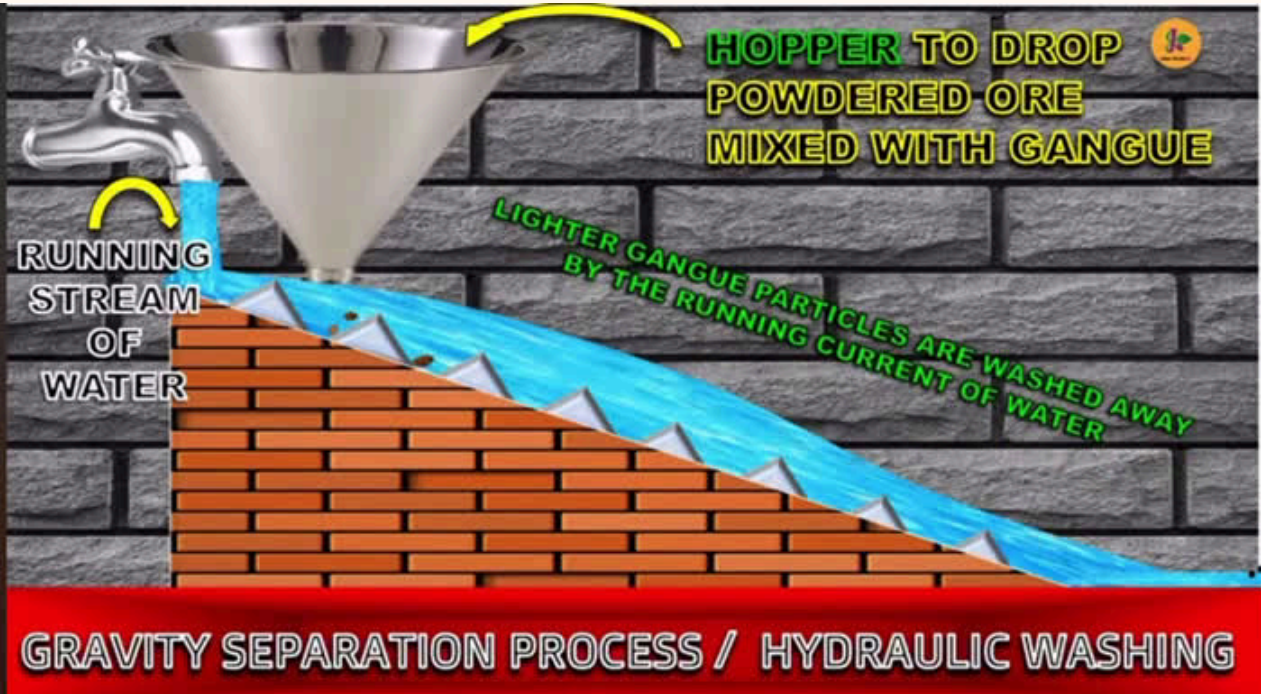
MAIN STEPS IN A TYPICAL E-WASTE RECYCLING PROCEDURE



SEPARATION METHODS

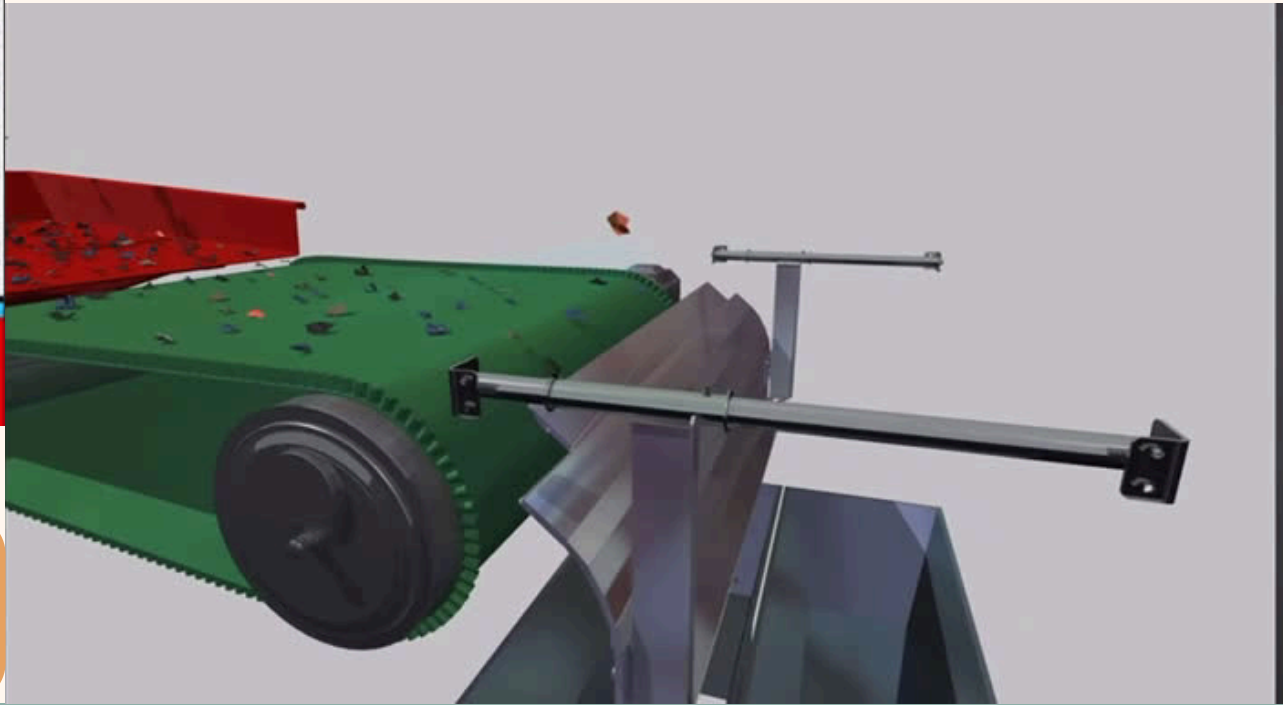


Magnetic separation



Gravity separation

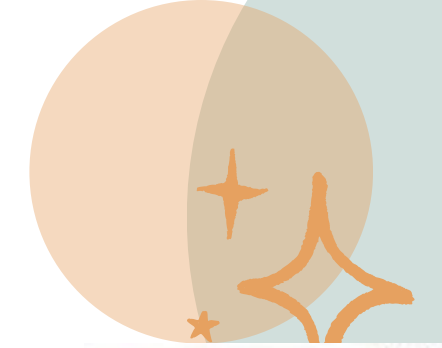
Eddy current Separation



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1. <https://link.springer.com/article/10.1007/s13762-022-04274-w>
2. <https://youtu.be/zlwpEzcamcc?si=JRaa7vWCP0e3FP0w>

OPPORTUNITIES AND LIMITATIONS OF VARIOUS FORMAL E-WASTE RECYCLING METHODS



Pyrometallurgical

opportunities

It can **recover valuable metals** very well, often more than **95%**.

It can handle many **different types of e-waste materials**, including lithium, nickel, iron, copper, molybdenum, manganese, and cobalt.

It effectively **deals** with **toxic and dangerous substances** found in e-waste.

It leaves behind **very little waste**.

limitations

Significant **water** consumption

Loss of some **valuable materials**

Difficult or even **impossible** for **non-metallic materials**

High capital and **operational costs**

Harmful **air pollutants**, such as dioxins and furans

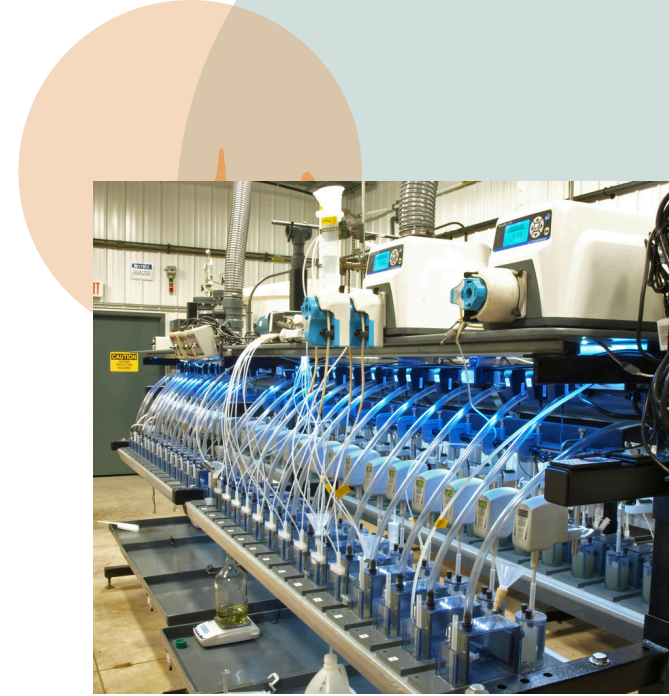
Significant **energy consumption** and its environmental burdens



References

1. Yifeng He et al, [Driving sustainable circular economy in electronics: A comprehensive review on environmental life cycle assessment of e-waste recycling](#), Environmental Pollution 342 (2024) 123081

OPPORTUNITIES AND LIMITATIONS OF VARIOUS FORMAL E-WASTE RECYCLING METHODS



Hydrometallurgical

opportunities

Extracting a **wide range of metals**, even from e-waste that has **low metal content**

Recovering strong, **heat-resistant**, and **chemical-resistant metals** from e-waste, like **lithium**, which are hard to extract with high-heat methods

More **energy-efficient** than **pyrometallurgical** recycling, resulting in lower energy costs

Requiring **lower energy consumption** and **reducing** associated **harmful emissions**

limitations

Complex process that uses a lot of **energy** and large amounts of **water** and **chemicals**.

Expensive **equipment** and **chemicals**, which increase the operational costs

Skilled operators with **higher salaries** for the operation

Produces a lot of **wastewater** and other **waste products**

Uses chemicals that can **harm the environment** and **human health**

References

1. Yifeng He et al., [Driving sustainable circular economy in electronics: A comprehensive review on environmental life cycle assessment of e-waste recycling](#), *Environmental Pollution* 342 (2024) 123081

OPPORTUNITIES AND LIMITATIONS OF VARIOUS FORMAL E-WASTE RECYCLING METHODS

opportunities

A promising option for recycling e-waste because it needs **simple equipment** and **works at low temperatures**

Can produce **high-purity metals** that are suitable for various **industrial uses**

creates other **valuable products**, like **biofuels**, **organic acids**, and other biochemicals, which improves resource recovery

Helps **reduce greenhouse gas** emissions by **repurposing** e-waste components

Biometallurgical

limitations

Unsuitable for some types of metals

Slower than methods like **pyrometallurgical** recycling

Highly **dependent** on specific **environmental conditions** and the **type of microorganism** used

High **initial costs** for **setting up** and **maintaining**

Produces **toxic byproducts**, such as **hydrogen sulfide** and **sulfur dioxide**

Significant **energy consumption**



CONCLUSION



E-waste recycling is a **crucial process** that helps **manage** the growing problem of **electronic waste**.

By **understanding** and **participating** in e-waste recycling, we can all play a part in **creating a more sustainable future**.

