

# Proposal for the Design of the Automobiles Tires Recycling Line

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## Abstract

A Proposal for the Design of Automobiles Tires recycling Line on a land area of 6000 m<sup>2</sup>, with better characteristics is presented .

The number of cars all over the world is increasing year after year. This need the improvement of the level of car service, Specially vehicle tire needs a high level of maintenance, in orders to achieve customer satisfaction. This could be done by constructing a number of recycling lines of tires that are capable of achieve customer needs.

## I. INTRODUCTION

Tire recycling is the process of recycling waste tires that are no longer suitable for use on vehicles due to wear or irreparable damage. These tires are a challenging source of waste, due to the large volume produced, the durability of the tires, and the components in the tire that are ecologically problematic.

## II. Tire machining & life cycle

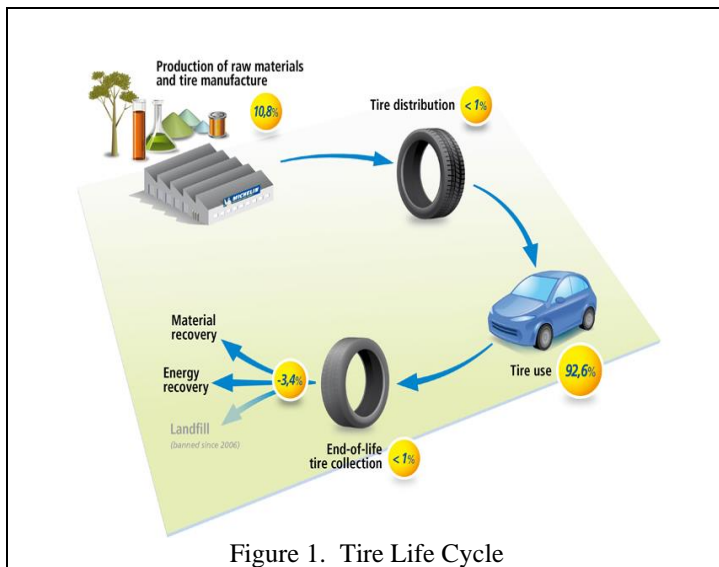


Figure 1. Tire Life Cycle

A. The tire life cycle can be identified by the following six steps:

1. Product developments and innovations such as improved compounds and camber tire shaping increase tire life, increments of replacement, consumer safety, and reduce tire waste.

2. Proper manufacturing and quality of delivery reduces waste at production.
3. Direct distribution through retailers, reduces inventory time and ensures that the life span and the safety of the products are explained to customers.
4. Consumers' use and maintenance choices like tire rotation and alignment affect tire wear and safety of operation.
5. Manufacturers and retailers set policies on return, retread, and replacement to reduce the waste generated from tires and assume responsibility for taking the 'tire to its grave' or to its reincarnation.
6. Recycling tires by developing strategies that combust or process waste into new products, creates viable businesses, and fulfilling public policies.

### B. Landfill disposal :

Tires are not desired at landfills, due to their large volumes.

Tires can trap methane gases, causing them to become buoyant, or bubble to the surface.

### C. Stockpiles and legal dumping:

Tire stockpiles create a great health and safety risk. Tire fires can occur easily, burning for months and creating substantial pollution in the air and ground

Recycling helps to reduce the number of tires in storage.

Tire storage and recycling are sometimes linked with illegal activities and lack of environmental awareness.

### D. Wasted tire usage :



Figure 2. children Toys



Figure 3. Seats

- 1- The product is used to cover the floors of industrial fields, "artificial turf". Certainly, you have knowledge that industrial playgrounds have increased their spread recently in various regions, where they are considered one of the profitable projects at the present time.
- 2- Automobile factories that manufacture transport and trip buses paint floors with epoxy to prevent passengers from slipping in the event of standing or walking inside buses, it is worth noting that this epoxy material contains a high percentage of rubber granules provided by the project.
- 3- The product is used in the manufacture of brake pads with a proportion of up to 40% of brake pads components. It is worth noting that there are different factories in our country for the manufacture of brake pads and they are often found in industrial areas.
- 4- Railroad factories also need the product provided by the project as it is relied upon in the manufacture of brakes for trains.
- 5- The product is used in construction projects, insulation and building floors.
- 6- A percentage of 15-20% of the mixture is used in asphalt mixtures, which is definitely high.
- 7- It is used as an additive for adhesives and sealants.
- 8- It is used as anti-shock, skidding and general safety.
- 9- The product provided by the project is used in many rubber and plastic industries.
- 10- It is used to manufacture rubber tiles that are used in parks, children's play areas, waterfronts, fitness centers, gyms, training halls, and others.

#### E. Tire Pyrolysis

The pyrolysis method for recycling used tires is a technique which heats whole or shredded tires in a reactor vessel containing an oxygen-free atmosphere.

In the reactor the rubber is softened after which the rubber polymers break down into smaller molecules. These smaller molecules eventually vaporize and exit from the reactor. These vapors can be burned directly to produce power or condensed into an oily type liquid, generally used as a fuel.

### III. Machines used for recycling



Figure 4. Recycling Process

#### A. Shredder:

LIKE's two shaft shredders are specially designed for used tires, low speed, high torque operation minimize the noise and power consumption with high throughput rate. the shredder can process OTR tires, big truck tires, passenger car tires at a rate of 1t-30t in one hour.

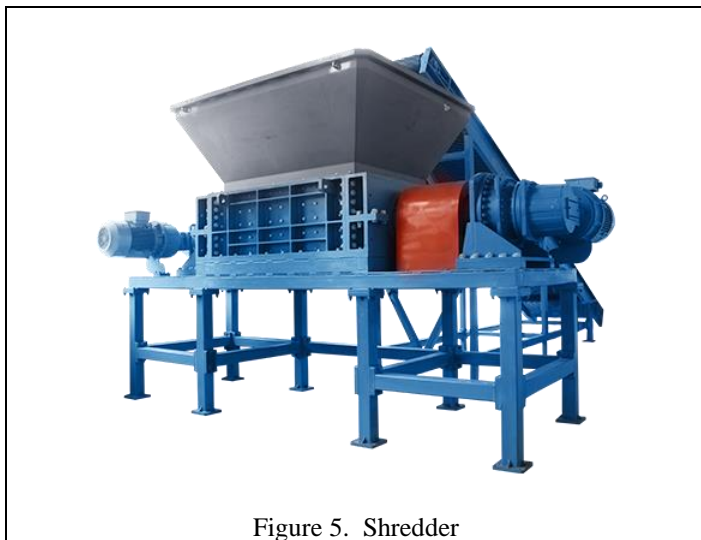


Figure 5. Shredder

B. Debeader:

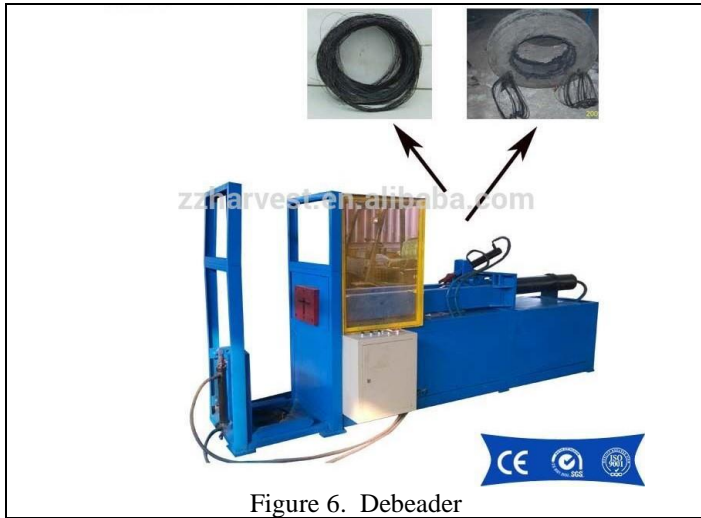


Figure 6. Debeader

C. Tire cutting:

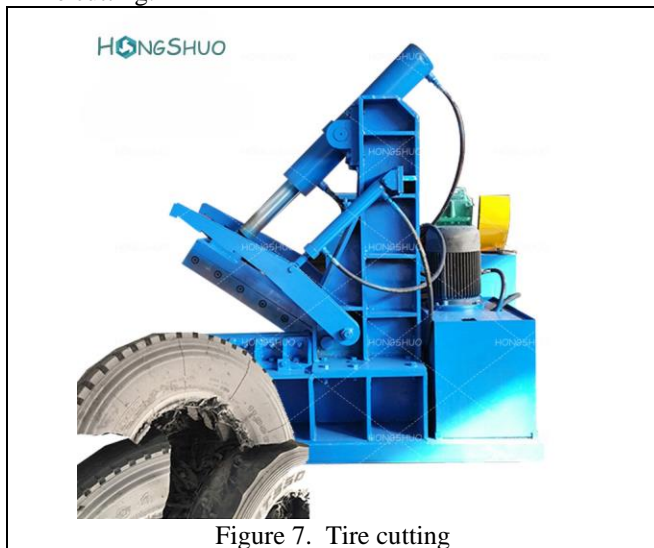


Figure 7. Tire cutting

D. Steel wire separator:



Figure 8. Steel Wire Separator

E. Magnetic separator:

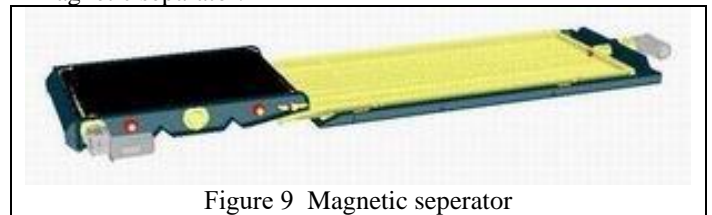


Figure 9. Magnetic separator

F. Fiber Separator:

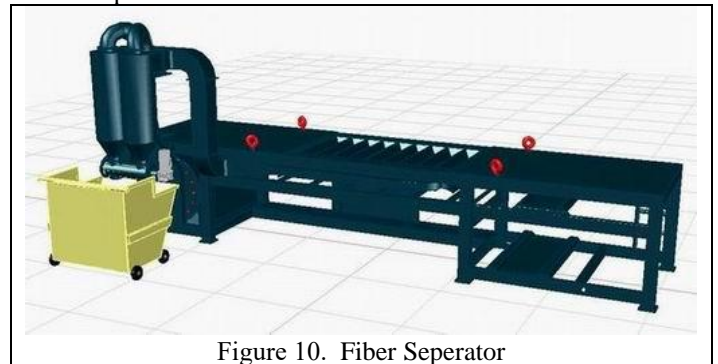


Figure 10. Fiber Separator

G. Applications OF TIRES

- 1- Automotive tires.
- 2- Light-medium duty Tires: Light-duty tires for passenger vehicles carry loads in the range of 550 to 1,100 pounds (250 to 500 kg) on the drive wheel.



Figure 11. Light-medium duty Tires

- 3- Heavy duty Tires: Heavy duty tires for large trucks and buses come in a variety of profiles and carry loads in the range of 4,000 to 5,500 pounds (1,800 to 2,500 kg) on the drive

wheel. These are typically mounted in tandem on the drive axle.



Figure 12. Heavy duty Tires

4- Other Application of tires: Aircraft, bicycle and a variety of industrial applications have distinct design requirements.



Figure 13. Aircraft tire

#### IV. Layout

##### Main Sections

- 1- Reception Department .  
This department is important because it is the only department that deals with customers. Therefore, it takes great attention.
  - Main sections of reception department :
    - a- Parking zone for vehicle to be receive.
    - b- Reception office.
    - c- Customer reception hall.
    - d- Operation hall.
    - e- Cashier.
- 2- Management Department.  
Contains :
  - a- General manager
  - b- Marketing manager
  - c- Financial manager
  - d- Store manager

#### V. Line safety

Fire safety of factories include preventive and protective measures to be taken to eliminate the causes and sources of fire, and if a fire starts, prevent its disastrous action in the personnel, and ensure protection of building, equipment , machines, etc.

In the factory :

- 1- Always keep your workplace clean to protect yourself and other from injury .

- 2- Do not leave tools or parts on the floor where you or somebody else may trip over them .
- 3- Immediately clean up any spilled fuel , oil to prevent yourself or others from slipping on the floor .
- 4- Be careful when handling heavy objects .

#### Conclusion

**From the current study the following can be drawn :**

- 1- **Main application of tires we:**
  - a- Light medium duty.
  - b- Heavy duty
  - c- Other users such (air craft and bicycle tires )
- 2- **The materials used in tires production are:**
  - a- Synthetic rubber
  - b- Natural rubber
  - c- Fabric and wires
  - d- Carbon black
  - e- Other chemical compounds
- 3- **The construction of tire is :**
  - a- Radial tire construction utilizes body ply cords extending from the beads and across the tread so that the cords are right angles and parallel to each others, the belts may be cord or steel .
  - b- Bias tire utilizes body ply cords that extend diagonally from bead to bead at angles 30 to 40 degrees with successivly plies laid at opposing angles forming crisscross pattern to which the tread is applied.
- 4- **The manufacturing steps are:**
  - a- Tire cutting
  - b- Tire shredder
  - c- Steel separator
  - d- Magnetic separator
  - e- Rubber granulator
  - f- Fiber separator
- 5- **Basic machine tools :**
  - a- Scrap tire .
  - b- The debader .
  - c- tire cutter.
  - d- the shredder.
  - e- fiber separator.
  - f- rubber granulator .
  - g- magnetic separator.
  - h- steel wire separator.

**The cost were estimated to be :**

The tire recycling plant has the following working process to make waste tire to rubber powder.

Waste tire ⇒ ring cutter ⇒ strips cutter ⇒ block cutter ⇒ big conveyor ⇒ rubber crusher ⇒ big shaking screen ⇒ small conveyor ⇒ big magnetic separator ⇒ small shaking screen ⇒ small magnetic separator ⇒ fiber separator ⇒ 5-30 mesh rubber powder ⇒ rubber grinder ⇒ 1-120 mesh fine rubber powder, its output is 200 kg/h for around 5-30 mesh rubber powder. The cost is about 22,000 dollars.

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