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Introduction :

Tires damaged one of the solid waste does not degrade and take a great deal of physical space, which can not be compressed and collected and eliminate it, and consists of dangerous elements such as lead, chromium and cadmium and other heavy metals, and when to get rid of these tires or management improperly constituted a threat to the health and the environment.

And is a global problem that plague the world for what caused the risk and spread of insect pathogens, and there is a growing realization in all countries in the world to the problem of handling the increasing amounts of tires damaged, which is compounded annually, is the Kingdom of the top consumers of tires, due to the large number of vehicle] cars , trucks [Imported by the Kingdom annually.

The Process Of Recycling :

Knowing of the process of recycling the past thousands of years, where he was using waste Chinese silk worm in fish in lakes with a view to retrieve the contents of the protein.

And the ability to rotate refers to the possibility to take advantage of the waste is non-existent in the eyes of their product value and environmental, any action taken to re-use of this waste at any cost is a great benefit, at least reduce the amount of waste dumped in the environment and this in itself is a gain.

Raw materials used in the manufacture of tires include rubber (41 percent), carbon black (28 percent), steel (15 percent) and other materials (16 percent).



STEEL



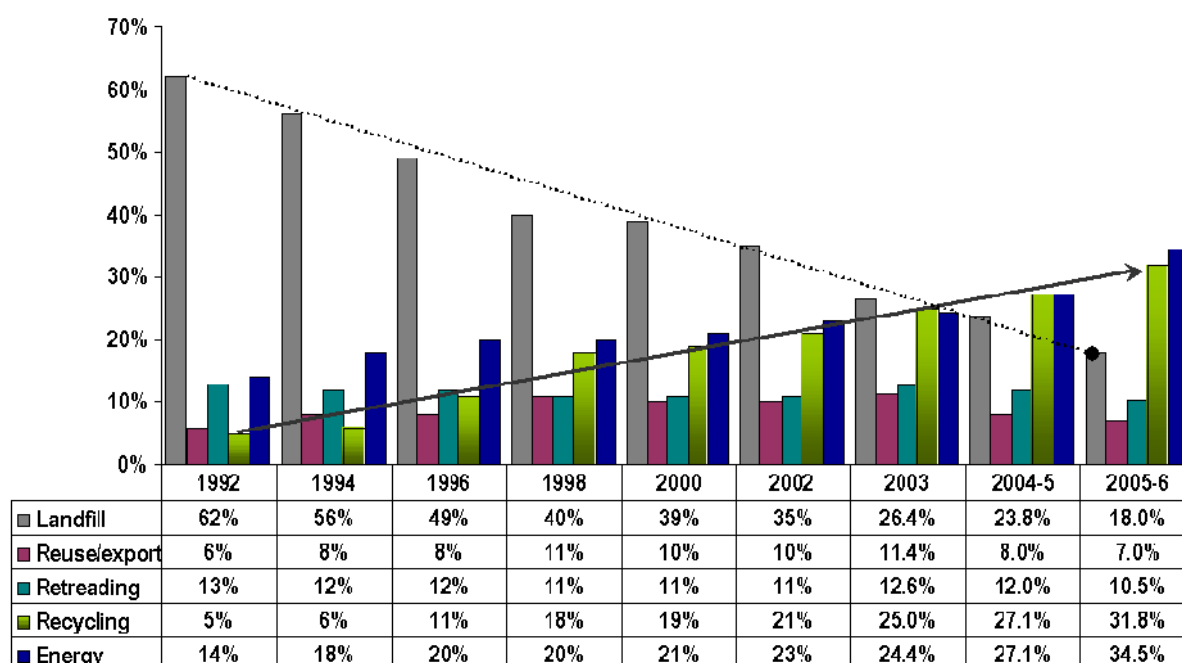
carbon black



Rubber

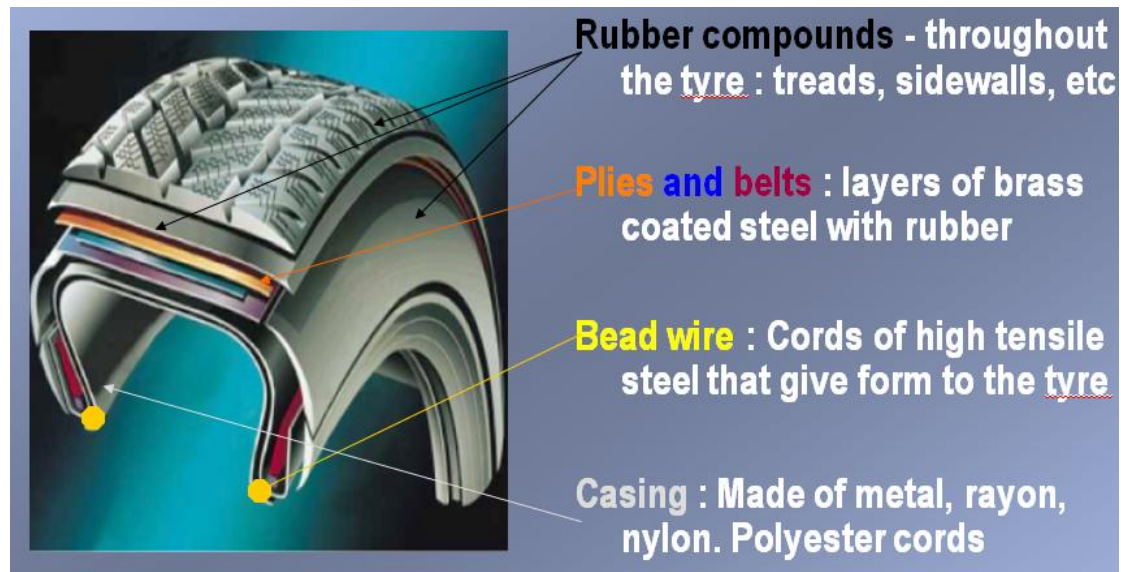
Did you know...

- It takes **seven** gallons of oil to produce **one** tire. Five gallons of butadiene and styrene gasoline comprises the substances that tires are made out of, and two gallons of gas are used to generate the energy needed to manufacture the tires.
- Dumping waste tires in non-designated areas is hazardous to our health and to our natural habitat, AND it is against the law.
- An estimated 250 million waste tires are discarded every year.
- If you and your parents perform certain tire maintenance steps such as rotation, inflation, balance, and alignment, you can extend tire life and decrease waste tire generation by 15 percent.
- It is important to recycle your tires because improper disposal/illegal dumping can result in fires that are difficult to extinguish. When tire piles catch fire, the melted rubber generates oil that can pollute surface and groundwater. Furthermore, tire piles tend to collect water creating a perfect breeding space for disease-carrying animals such as mosquitoes, snakes, and rats.



Graphic Illustration of the use of recycling rate with the passage of time

Inner composition of Tires :



More Stats For Tire Recycling...

The United States generates approximately one scrap tire for every person each year. 30 million of these tires are retreaded leaving the rest to be managed.

Besides this yearly generation there is an estimated 2 to 3 billion that have accumulated over the years and are contained in various stockpiles.

Of the total of recovered tires 60 percent is used as TDF or tire derived fuel. Scrap tires are a good source of fuel because they have a high heating value and produce low amounts of sulphur when burned.

In 2006 over **300 million** new tires were shipped out to be used by cars and trucks. About 80 percent (240 million) were used by passenger cars. About 20 percent (60 million) were used by trucks.

Tire lifecycle :

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](#) affect tire wear and safety of operation.
5. Manufacturers and retailers set policies on return, [re-tread](#), 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



Used tires in foreground waiting to be shredded and shredded tires in background.

how are they recycled, and what are they made into?

In the USA, reusing or recycling tires keeps them out of landfills. When buying new tires, leave your old ones at the dealer. Many communities have designated recycling drop-off centers where you can safely and responsibly dispose of your tires. The majority of recycled waste tires are used as a source of energy, otherwise known as tire-derived fuel or TDF. When heated in combustion facilities, most notably in cement kilns, pulp and paper mill boilers, and power utility boilers, energy is produced and used as fuel to power these facilities. Waste tires can also be used to make many useful objects. When all non-rubber material is removed from the tires, rubber chips are left over to make crumb-rubber modified asphalt, which is used to pave highways. Waste tires can also be made into doormats, water hoses, shoe soles, door stoppers, playground and athletic surfaces, non-slip products, sheet rubber for manufacturing products, and artificial reefs for marine life habitats.

Types of recycling tires:

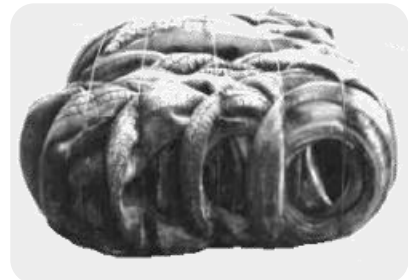
First : Whole tire : Whole tires can be recycled without physical chemical transformation , Principal methods of treatment or include cutting into halves or quarters, untreated or, treated by removing the beads or sidewalls, or by compression .

Examples of whole tires uses :

1) Slope stabilisation



2) Construction bale



3) Coastal and fluvial protection



4) Erosion control



- **Second : Shred and Chips** , Shred and chips are the result of mechanical processes by which tyres are fragmented into irregular pieces , Shred can vary in size from $\pm 75\text{mm}$ to 300mm in any dimension.



Shred tires



small shred

Examples of shred and chips :



Drainage systems

Compacted shred
(geotextile)

Loose unbound chips :

Compacted unbound chips

Bound chips



Landfill cell

Loose shred



Building insulation

Third , Granulate is the result of processing rubber to reduce it in size into finely dispersed particles from $\pm 1\text{mm}$ to $\pm 10\text{mm}$. There are two principal methods of production : ambient (irregular shape)and cryogenic (regular shape) , Ambient size reduction is the most common, particularly for larger truck tires.



Examples of granulate uses



Artificial turf



Road furniture



Running tracks



Indoor or outdoor
tiles/pavers



Sports arenas



Children's play grounds

Forth , Powders and fine powders ■

Fine granulate is the result of ambient or cryogenic processing to obtain finely dispersed particles of less than $\pm 2\text{mm}$. ■

Powders and fine powders are the result of processing and post-treating the material to obtain finely dispersed particles of $\pm 500\mu\text{m}$ - $<1\text{mm}$



Elements of the recycling process :

1) **Collecting (manual)** : Knowing where the tires are

- At small individual sites :

Garages, tire shops, small retailers, vehicle sales

-At large communal depots :

Tire distributors

Fleet managers

Municipal depots

Vehicle dismantlers



Collecting

2) **Sorting**

According to category : truck, passenger car, other

Road-worthy : undamaged with minimum 1.66mm tread

Retreadable : repairable casing in good condition

Non-retreadable : raw material for recycling



3) **Pre-treating** : Manual processes

Removal of debris

Rinsing - remove dirt, etc.

Cutting in halves/quarters

Debeading

i. Debeading

Truck tyres are debeaded

The steel is removed

A 60 second spurt at 150 kW/h/t is used

Clean tyre bead steel can substitute virgin material –
dependent upon use



The machine of Debeading



the result of machine

ii. Cutting

4) Processing (mechanical)

i. Shredding



The process of Shredding



the result of machine

ii. Granulating

- a. Sieving
- b. Packaging
- c. Storing
- d. Delivering



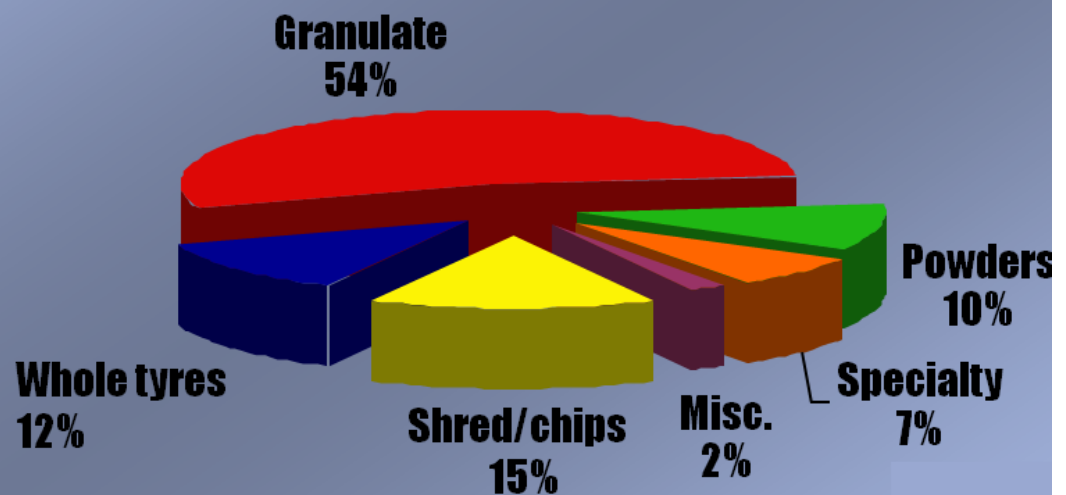
The machine of Granulating



the result of machine

Post-consumer tire materials

The changing balance of material production and use



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