



ผลิตภัณฑ์อย่างกับการรีไซเคิล

5 สิงหาคม 2558

# Rubber Products

From Latex

From Dry Rubber



NR

SR

NR

SR

# From Latex



# From Dry Rubbers

## TYRES



# From Dry Rubbers





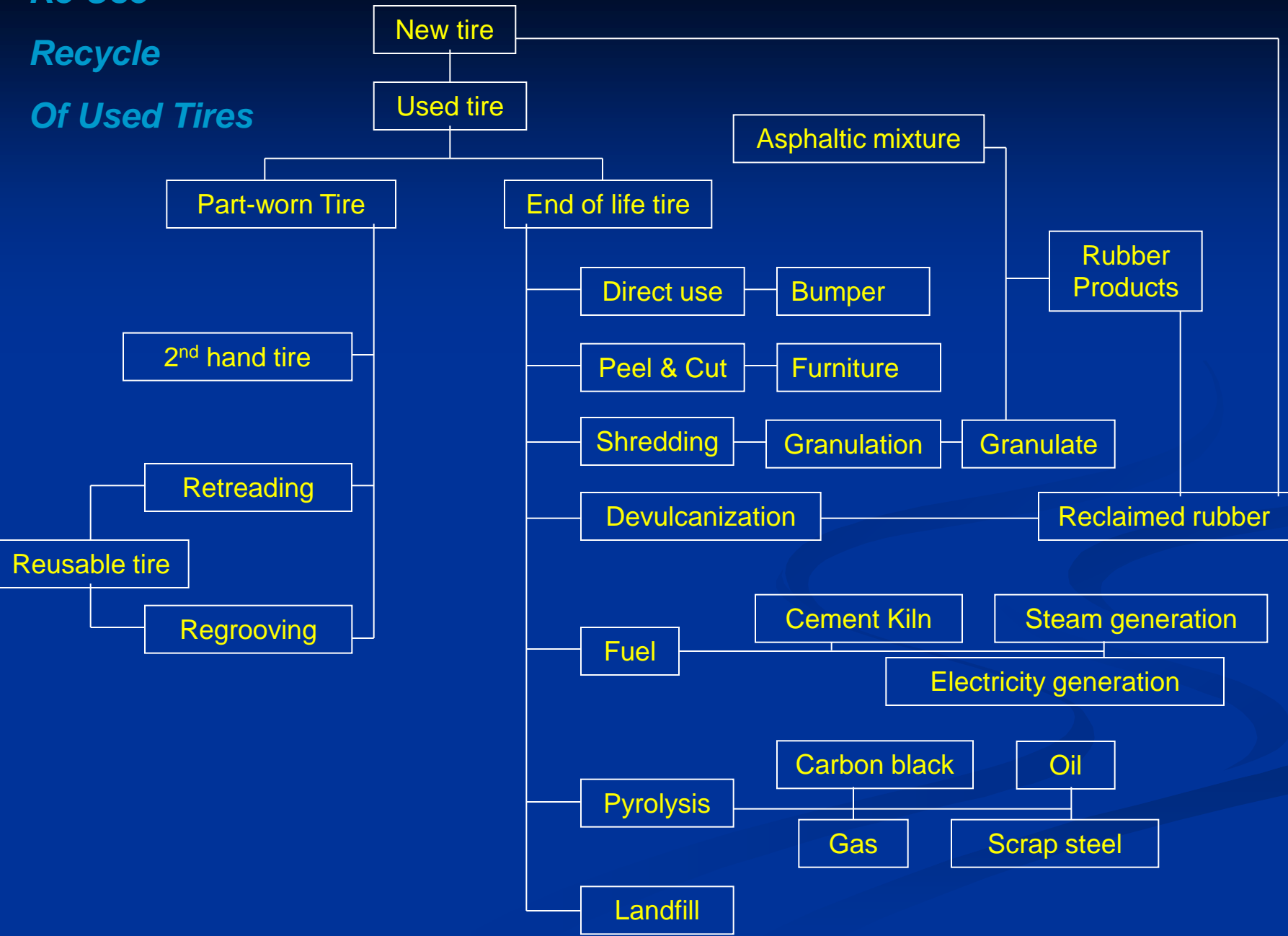


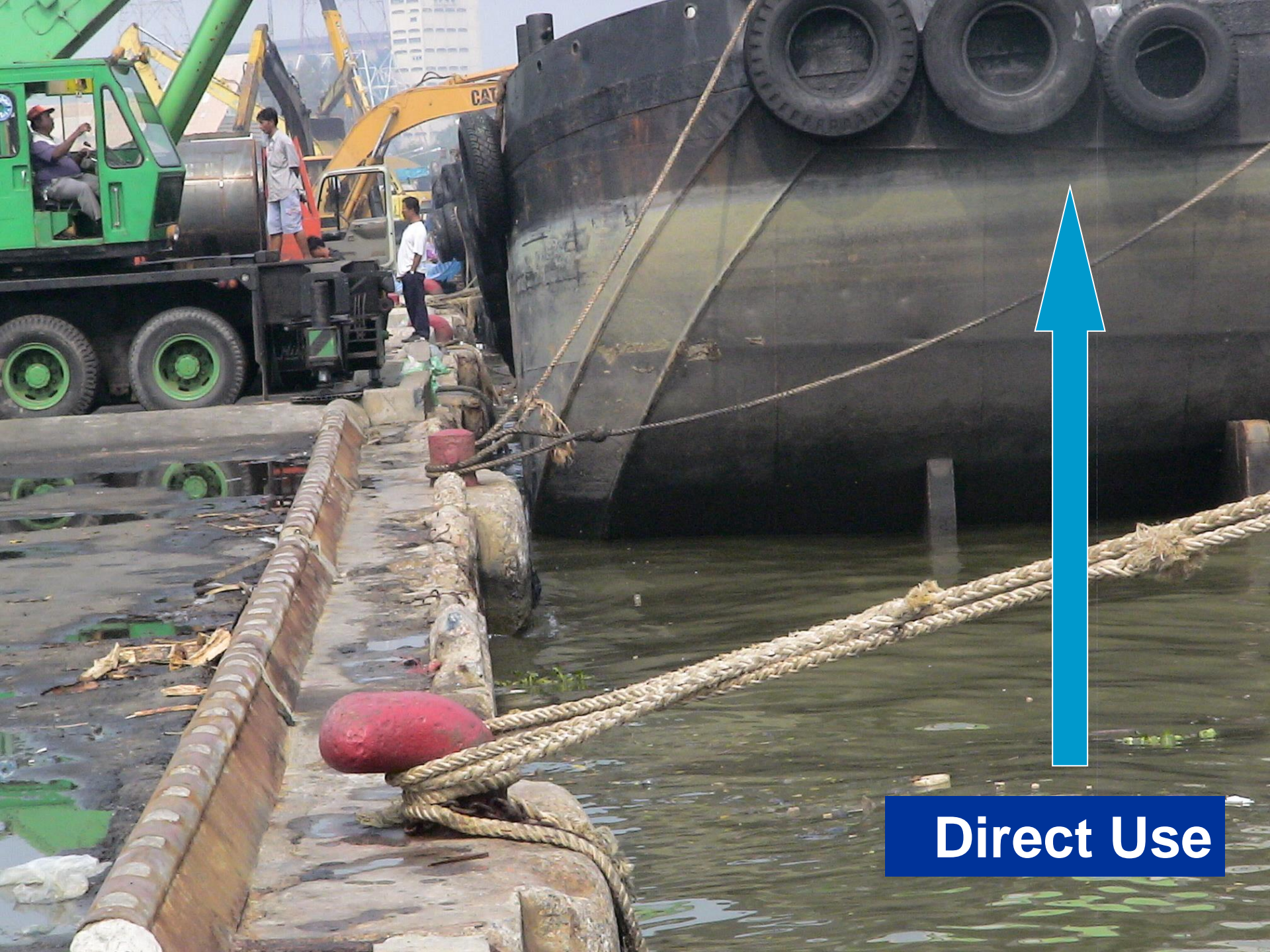






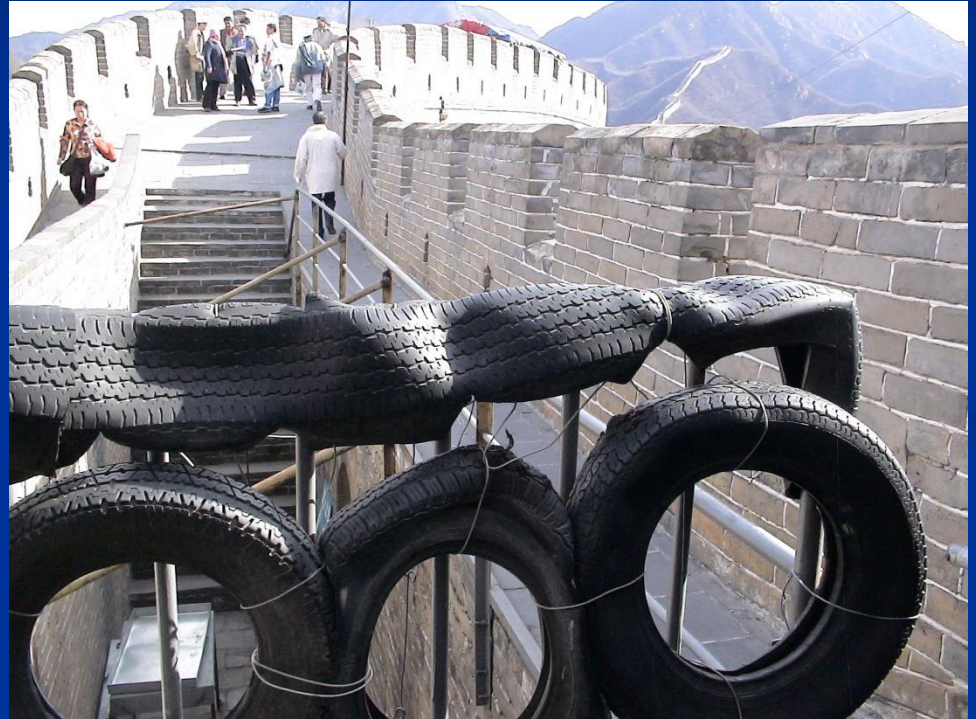
*Re-Use*  
*Recycle*  
*Of Used Tires*





**Direct Use**

# Direct Use



**Peel & Cut**





**Peel & Cut**

Peel & Cut





**Peel & Cut**



**Peel & Cut**





**Peel & Cut**

# Granulation (grinding)

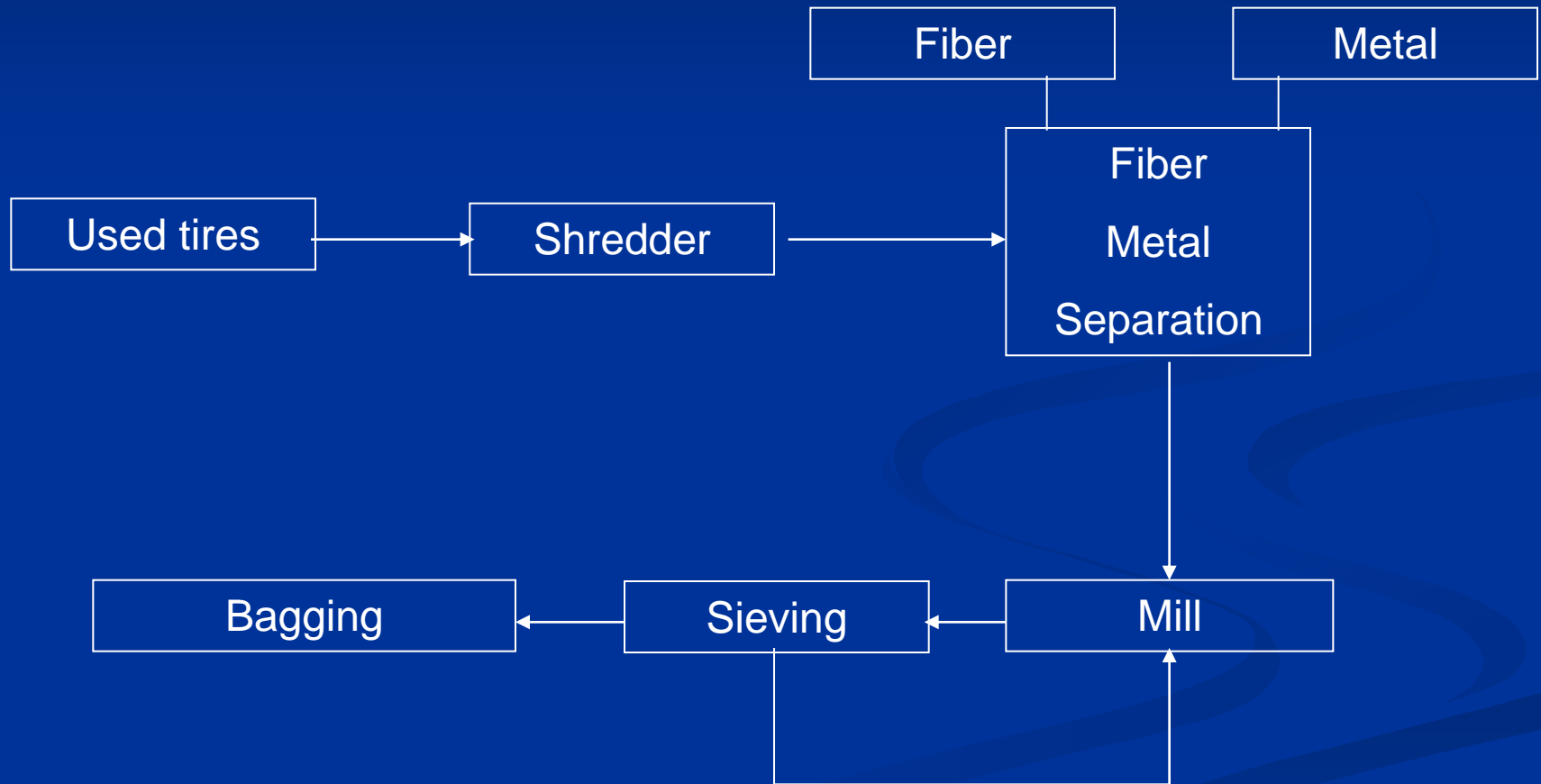
## Ambient Process

Mechanical grinding  
using steel rollers or  
blades

## Cryogenic Process

Low temperature freezing  
using liquid nitrogen with  
Hammer mill to crack  
frozen tires

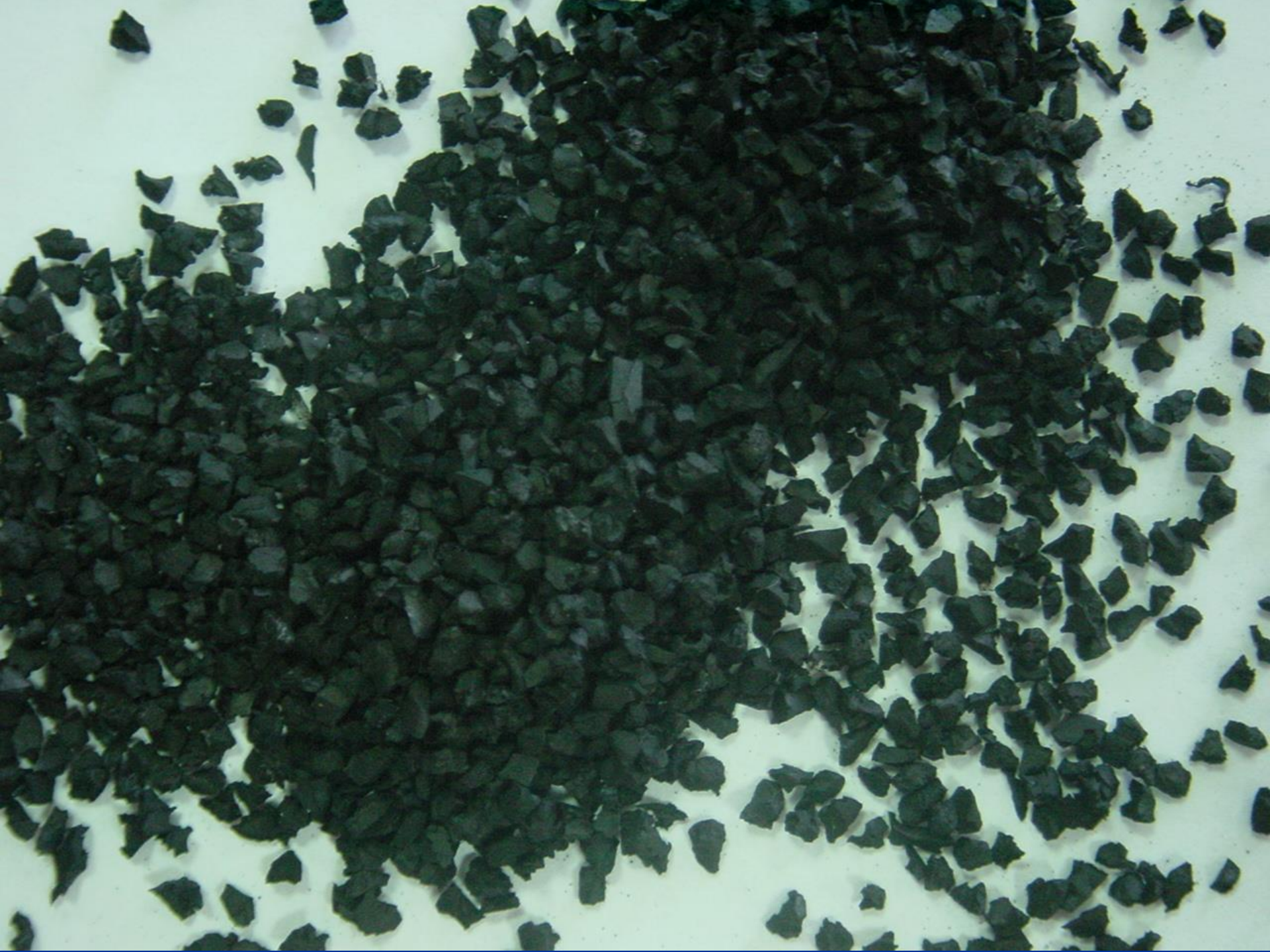
# Typical ambient grinding process



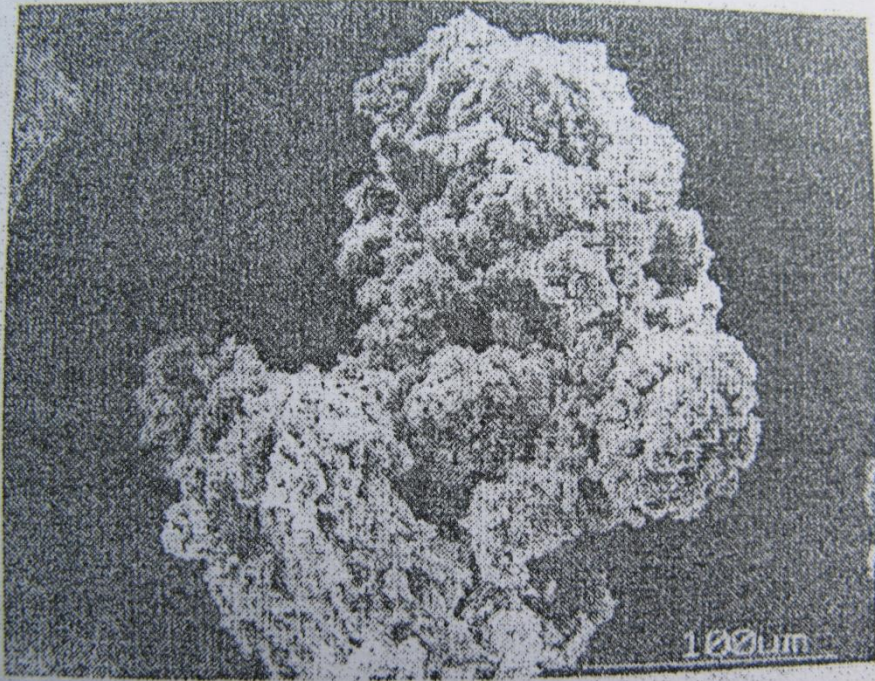
# Shredder



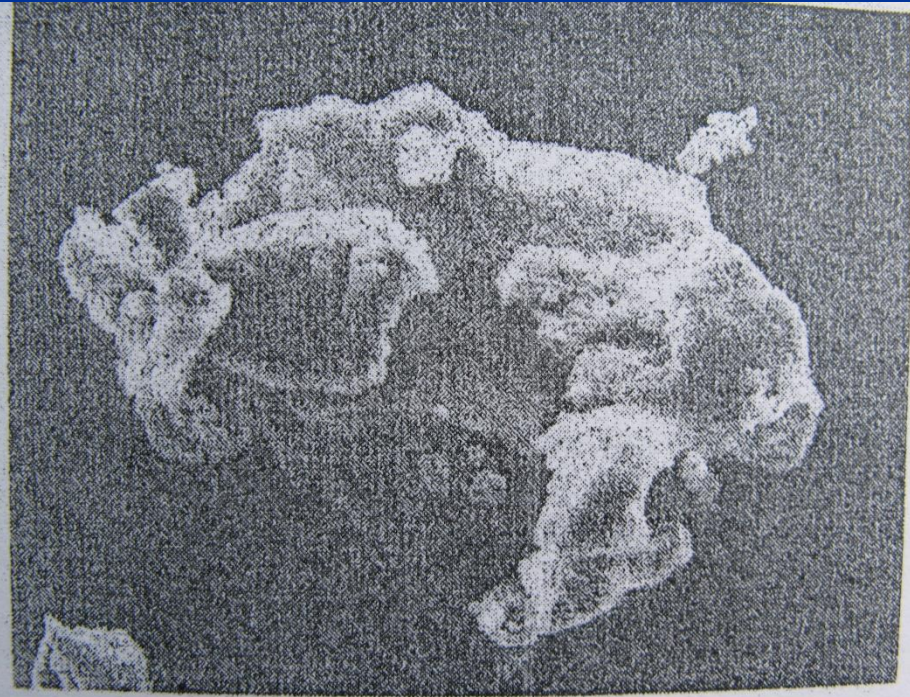




Ground tire rubber form  
Ambient grinding process

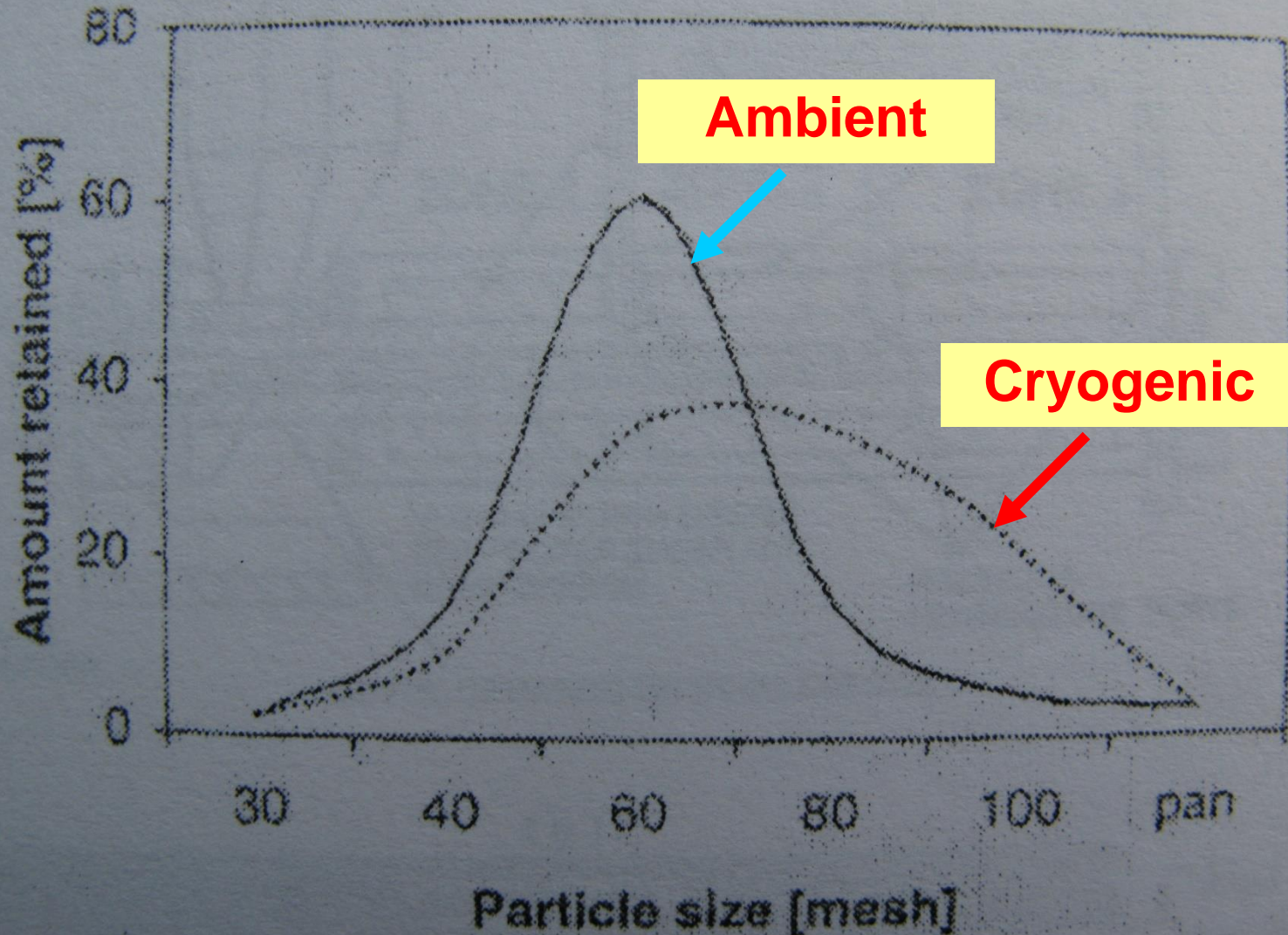


Ground tire rubber form  
cryogenic grinding process

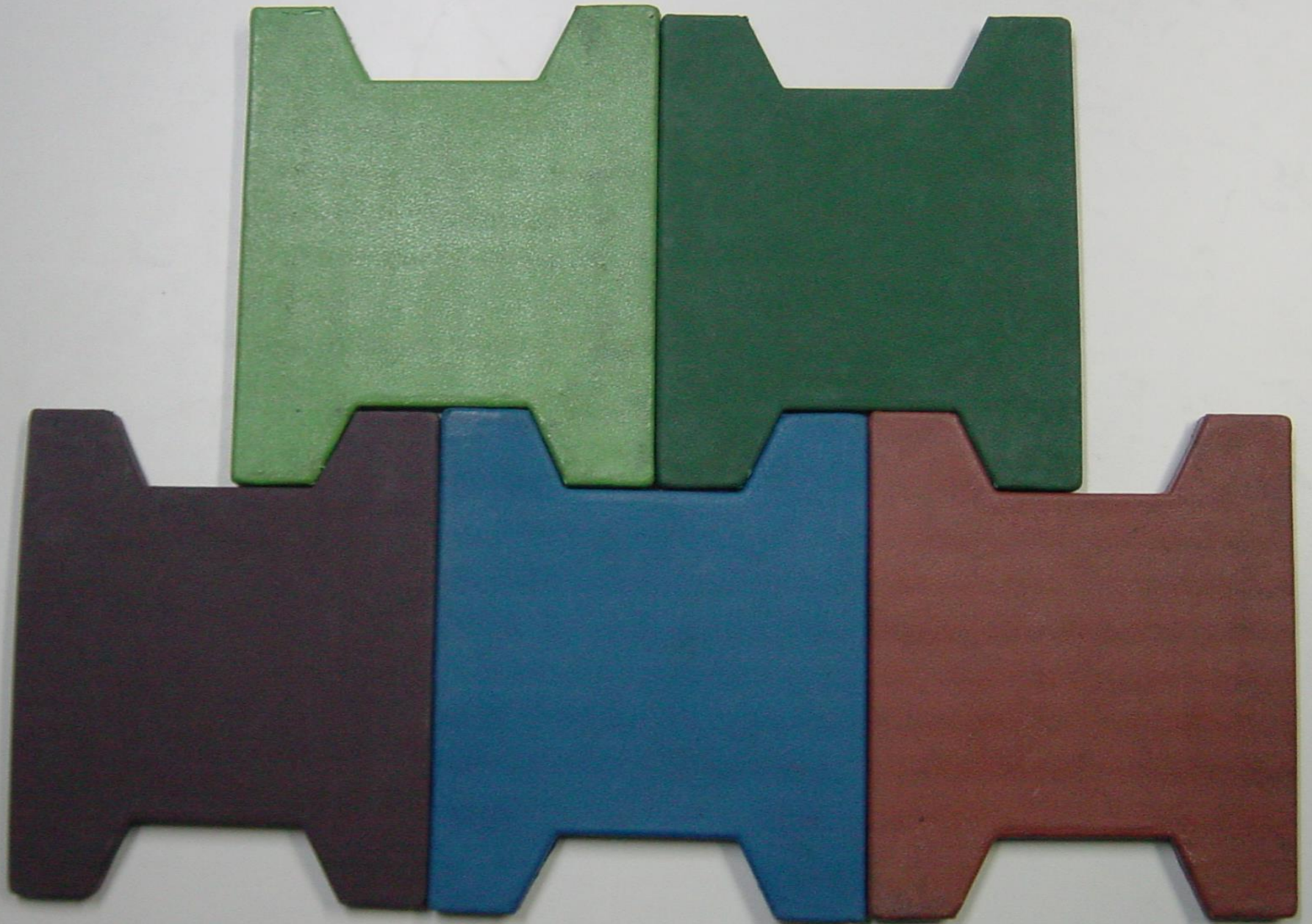




# Particle size distribution – Ambient vs Cryogenic



# Pavement Block



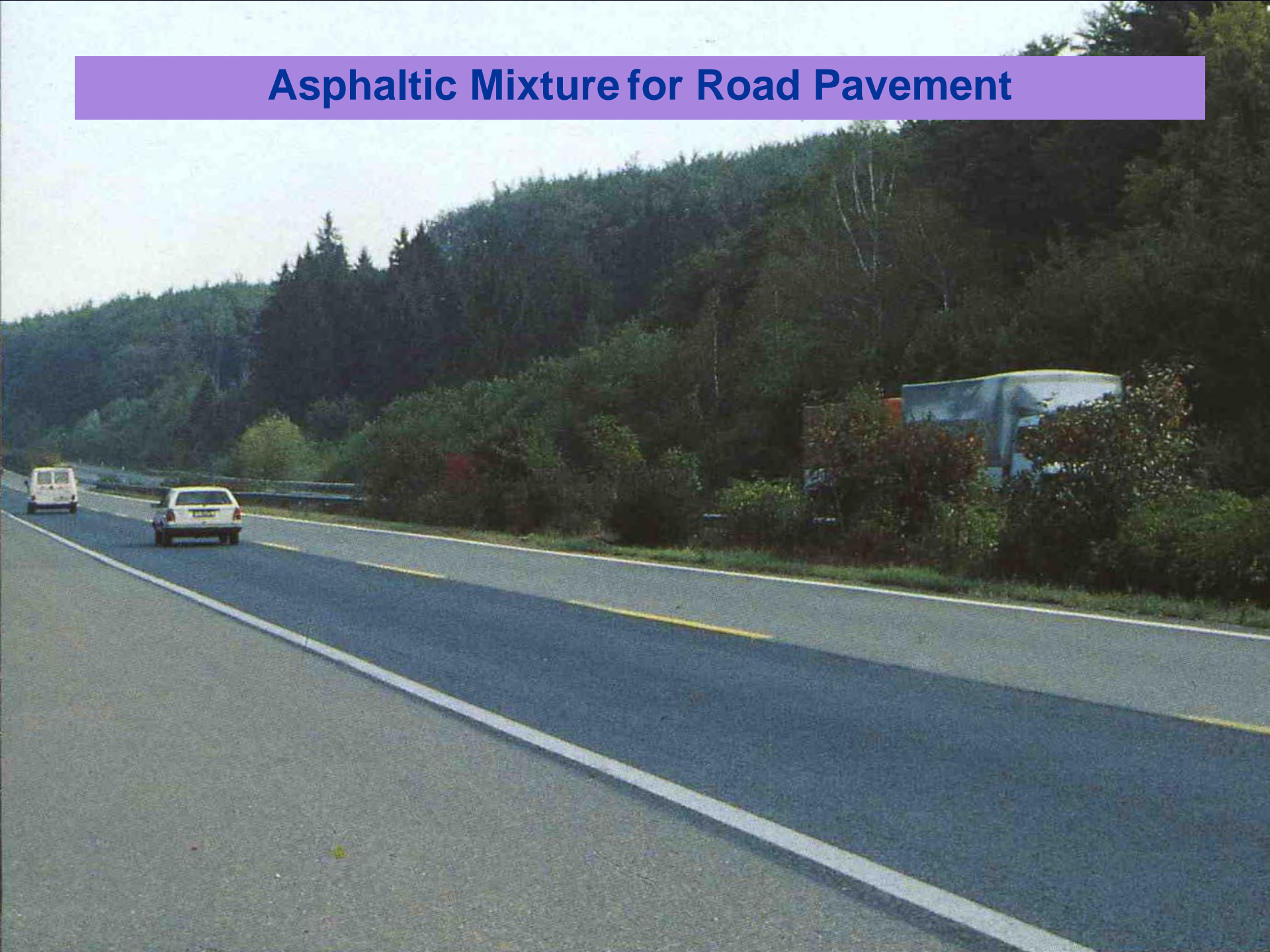


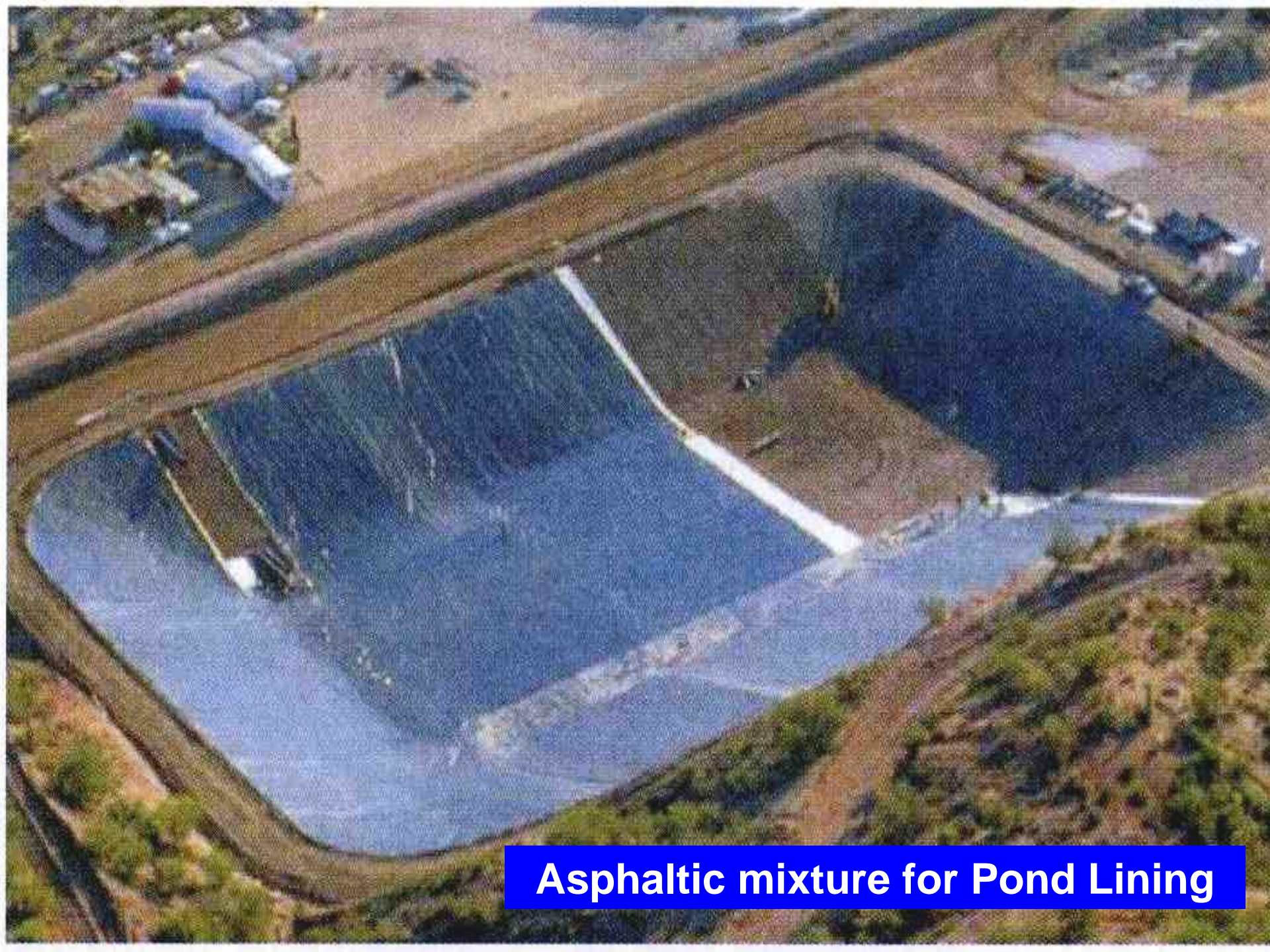






# Asphaltic Mixture for Road Pavement





**Asphaltic mixture for Pond Lining**



# Devulcanization Techniques

- Chemical + Heat
- Ultrasonic
- Microwave
- Biological
- Continuous Reactive Process

# Chemical + Heat

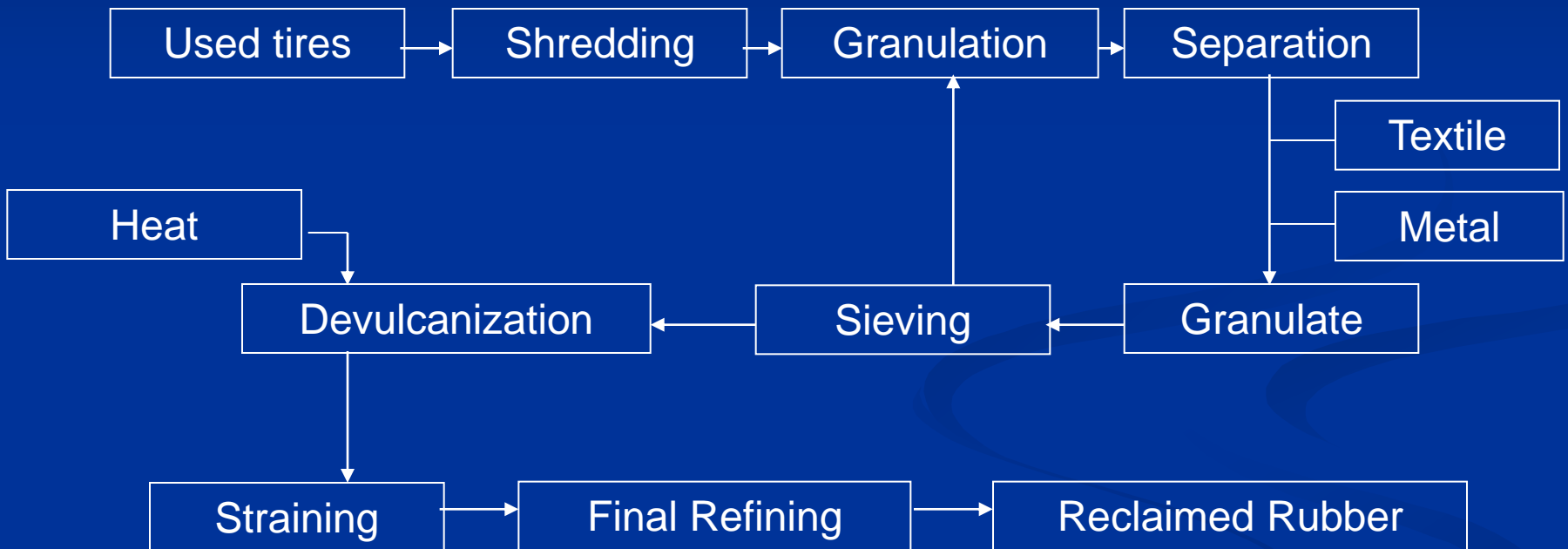
- De Vulc (DE-LINK technology)
- Devulcanizing agents + high temp + high pressure

Slow devulcanization time

Reaction takes place at the surface of the particles

# Example of Chemical Devulcanization

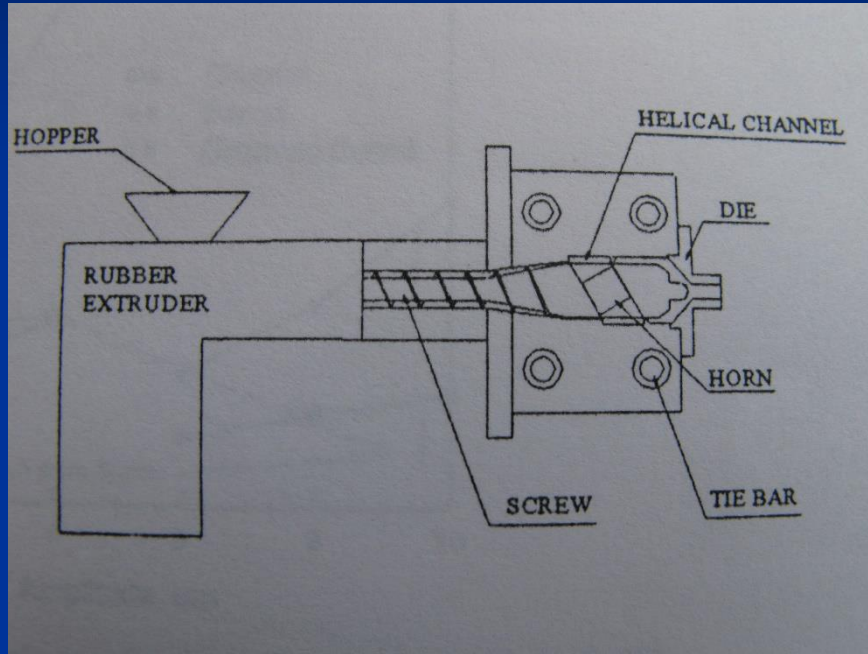
## Reclaimed Rubber



# Reclaimed Rubber Slabs



# Ultrasonic



Grooved Barrel

Ultrasonic Reactor

Short Devulcanization time

Reaction throughout particles

C-S, S-S are broken

No solvents involved

No chemicals involved

**GRT**

**Tire Curing Bladder**

**Unfilled Butyl Rubber**

**HNBR**

**EVA foam**

# Microwave

Use controlled microwave energy to devulcanize

C-S, S-S are broken

Materials to be applied with this process must be polar enough to accept the microwave energy to generate heat for devulcanization

Batch process

# Biological

Micro-organisms were used to attack S- bond

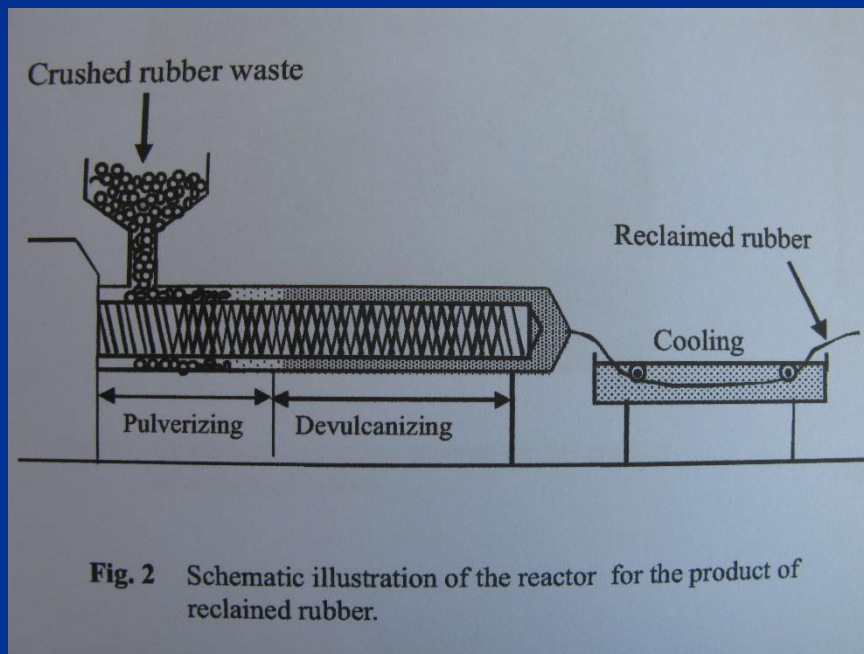
Various types of bacterias

Reaction takes place at the surface

Devulcanization time: 10 – 200 days

# Continuous Reactive Process

Introduced by Matsushita and Fukumori



Shear stress / Pressure /  
Temperature

Continuous process

Fast

Tire + Non tire are OK

Reclaimed rubber + TPE



# Pyrolysis

(Thermal decomposition of organic materials in the absence of air)

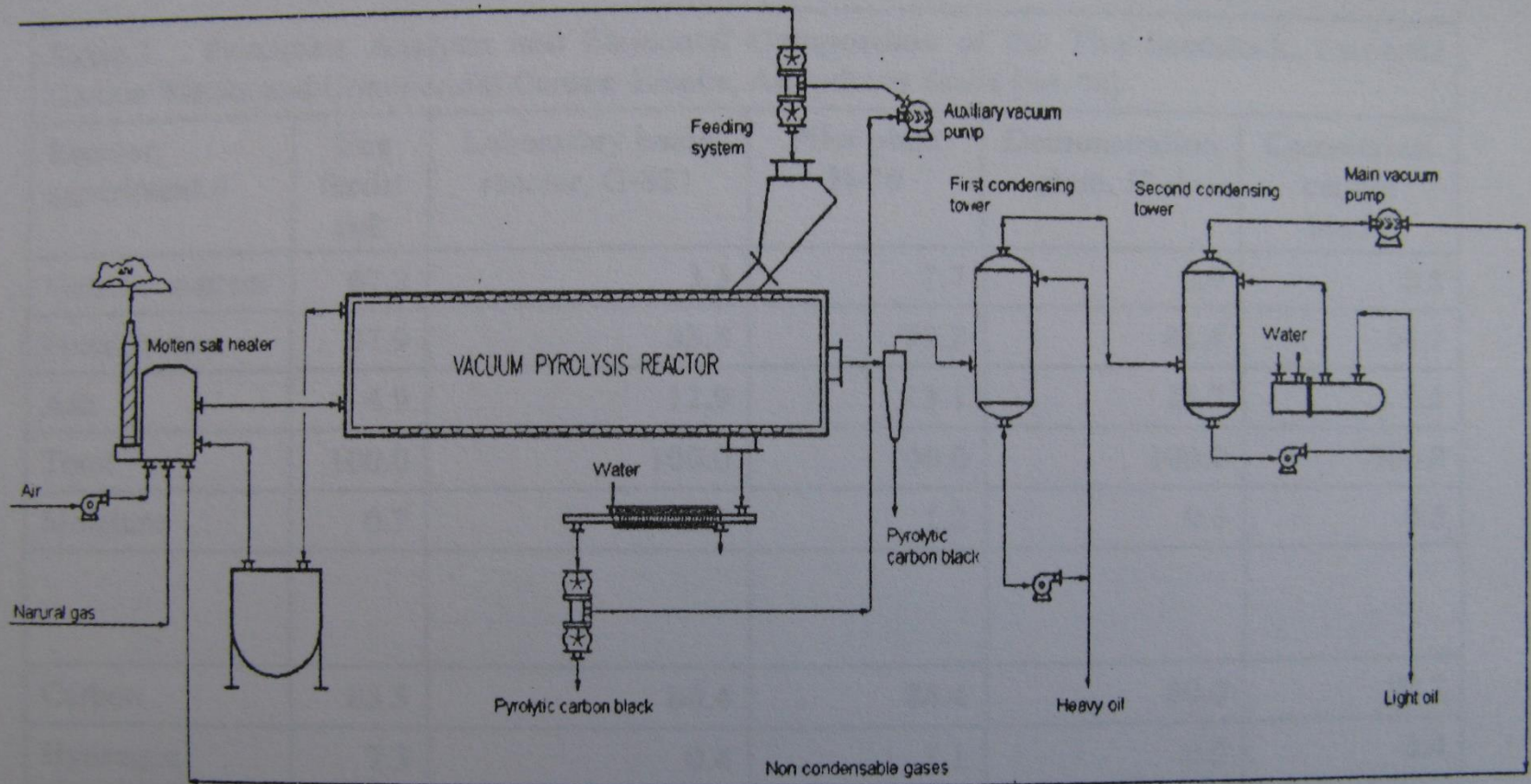
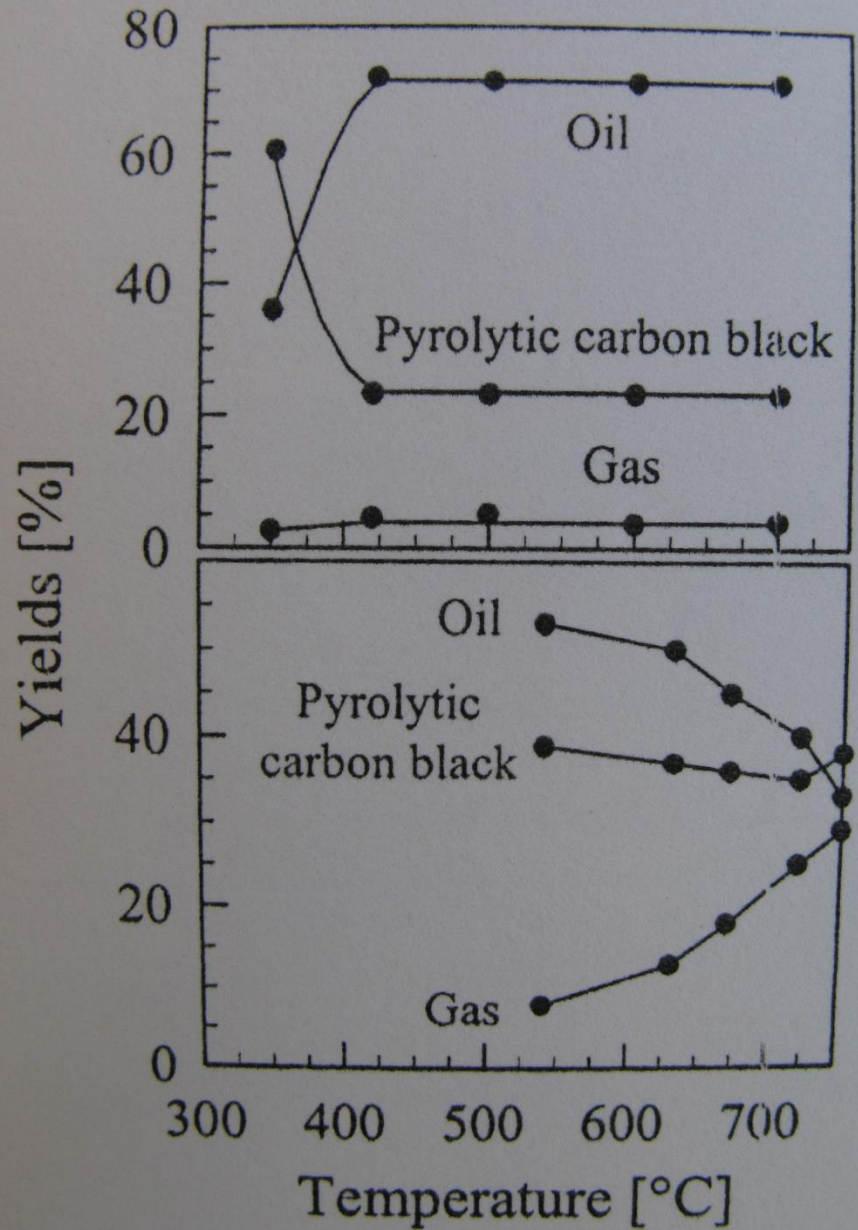


Fig. 3 Tire vacuum pyrolysis, process flow sheet

# yield

Under vacuum →

Atmospheric Pressure →



# Latex Gloves Recycling

NR latex scrap gloves



Grind



Devulcanization (Heat)



Sheeting



Latex Reclaimed Rubber



# Synthetic Rubbers Recycling

## Butyl Rubber



# Butyl Rubber Recycling

**Butyl Inner Tubes**



**Wash**



**Shred**



**Devulcanization (Heat)**



**Sheeting**



**Butyl Reclaimed Rubber**

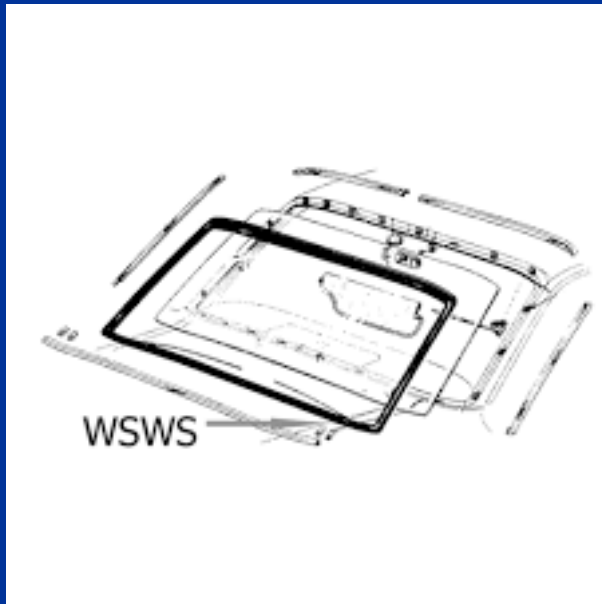


**Butyl Reclaimed Rubber**

# Synthetic Rubbers Recycling

## EPDM Rubber

Etylene Propylene Diene Terpolymer





# EPDM Rubber Recycling

Windscreen Seal / Wiper blade



Shred



Devulcanization (Heat)



Sheeting



EPDM Reclaimed Rubber

(Applications: hoses, roofing membrane)

# Synthetic Rubbers Recycling

## NBR Rubber Nitrile Rubber





**Product is worn in your facility**



**Waste is collected on site from each collection point**



**Materials are integrated into new eco-friendly products**



**Waste is sorted and processed at recycling partner**

**Source: Kimberly-Clark Nitrile Glove Recycling Program**

# Waste tire management in some countries

## USA

- Who pollutes who pays (Tax Model)
- Consumers pay the disposal fee when they buy new tires
- Tire shops pay waste disposal company to collect the tires
- Waste disposal company pays approved recyclers and cement companies to dispose used tires

# Waste tire management in some countries

Europe (Scandinavia, France, Benelux, some Eastern Europe)

- Indirectly paid by customers
- Tire manufacturers pay disposal taxes (PR)
- Government agency pay waste disposal company for collecting of used tires
- Waste disposal company pays approved recyclers and cement companies to dispose used tires

# Tons of waste tires in Thailand

Tire Type	2557	2560	2565	2566
PC	102,913	114,445	147,942	154,272
TB	197,648	286,536	524,861	592,643

Source: Michelin (Thailand)

Thank you