

**IECO Days**

**„Sustainable Material and Energy Transformation of Biomass“**

**October 6, 2021**

# **Plastic recycling**

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Universidad de Concepción**

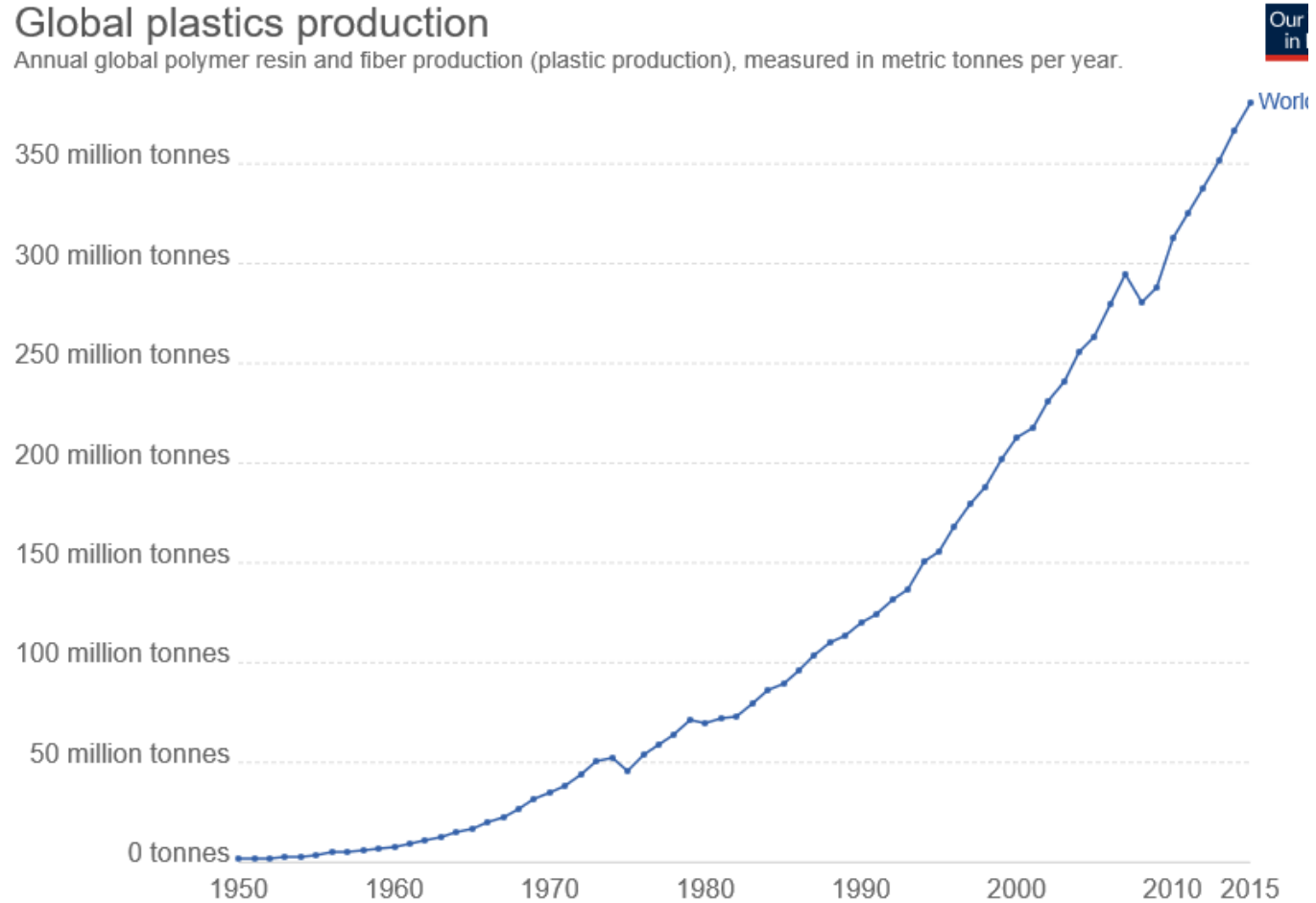
# Content

1. Plastic in our actual world
2. Mechanical recycling
3. Thermochemical recycling
4. Discussion

# Production, recycling and disposal of plastics

## Global plastics production

Annual global polymer resin and fiber production (plastic production), measured in metric tonnes per year.



# Production, recycling and disposal of plastics

## Global plastic production and its fate (1950-2015)

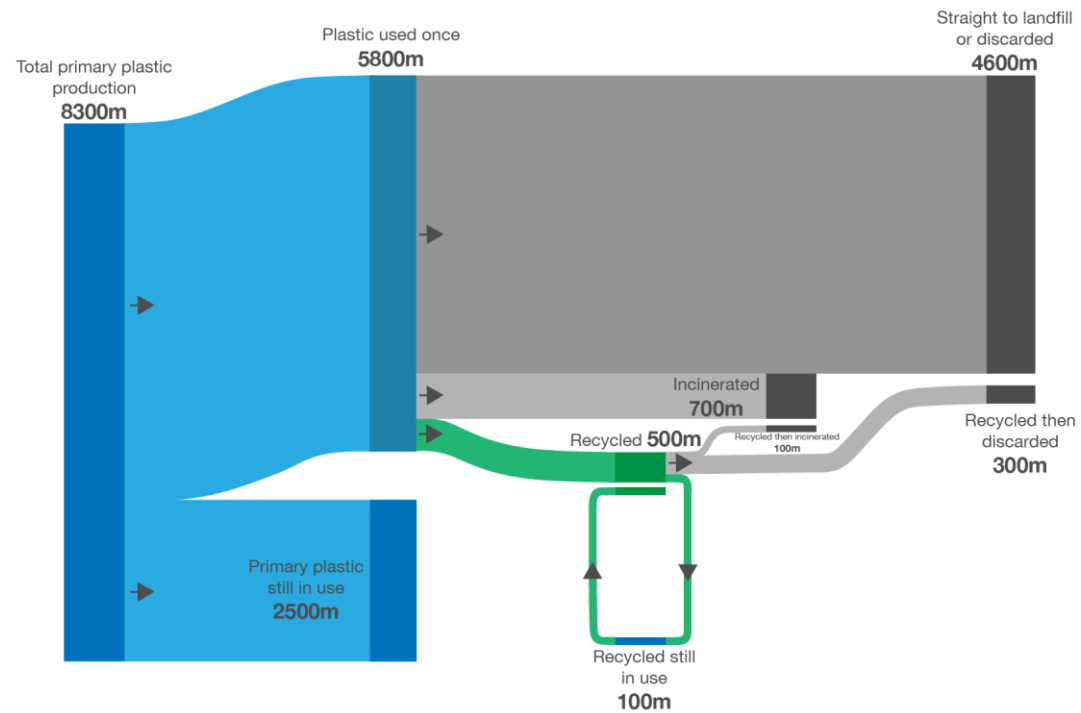


Global production of polymer resins, synthetic fibres and additives, and its journey through to its ultimate fate (still in use, recycled, incinerated or discarded).

Figures below represent the cumulative mass of plastics over the period 1950-2015, measured in million tonnes.

### Balance of plastic production and fate (m = million tonnes)

8300m produced → 4900m discarded + 800m incinerated + 2600m still in use (100m of recycled plastic)



Source: based on Geyer et al. (2017). Production, use, and fate of all plastics ever made. This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing. Licensed under CC-BY-SA by Hannah Ritchie and Max Roser (2018).

# Production, recycling and disposal of plastics

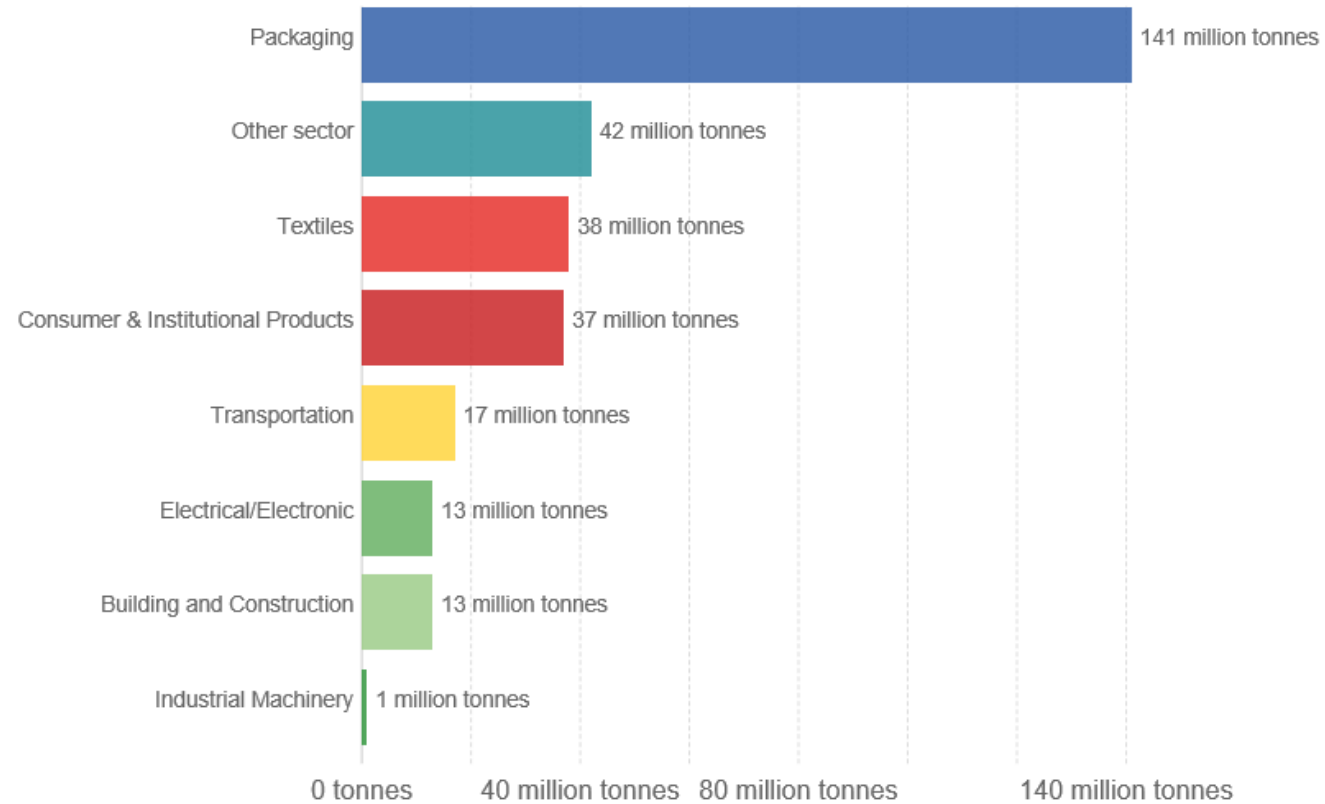


# Production, recycling and disposal of plastics

## Plastic waste generation by industrial sector, 2015

Global plastic waste generation by industrial sector, measured in tonnes per year.

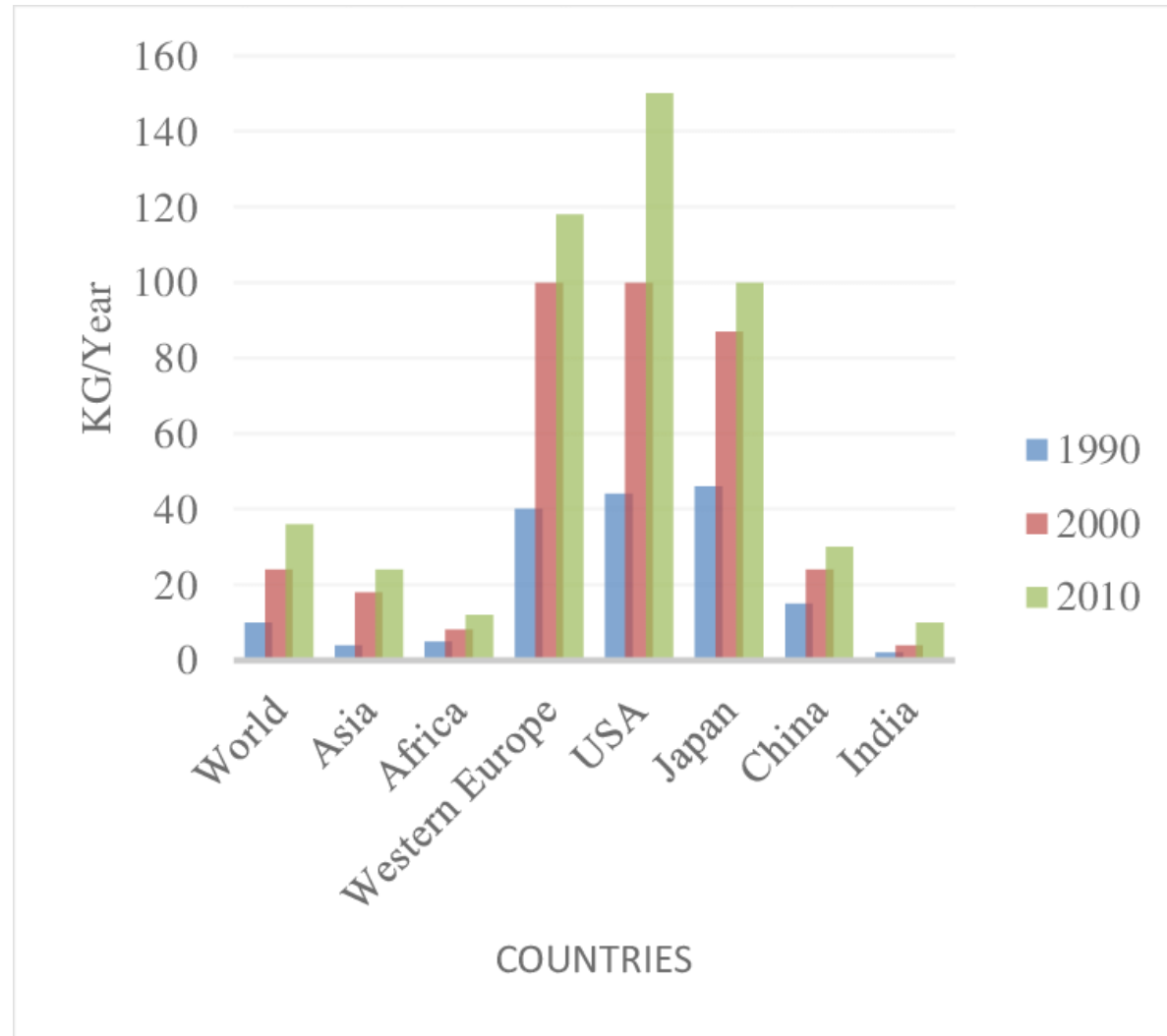
Our World  
in Data



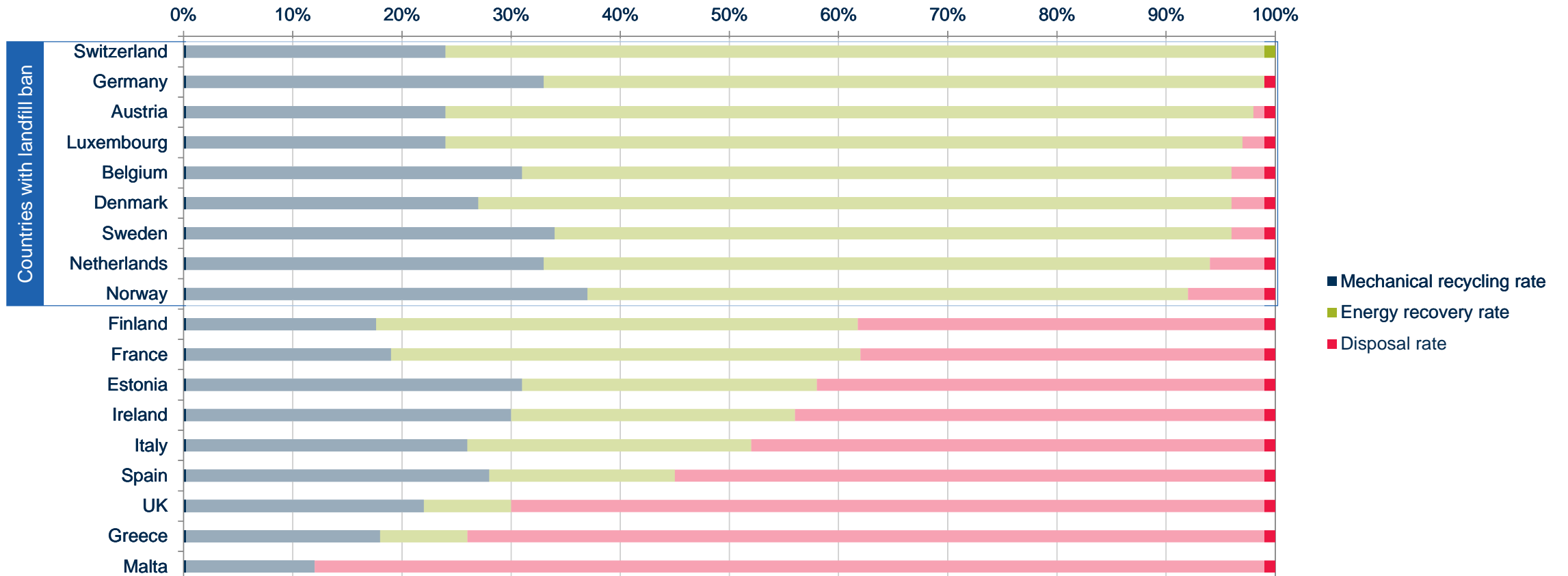
Source: Geyer et al. (2017)

CC BY

# Production, recycling and disposal of plastics



# Production, recycling and disposal of plastics





# Production, recycling and disposal of plastics

## Status quo in Chile

- Plastic consumption: 1 Million ton
- Recycling cuota: 8%
- Extended producer responsibility law (Ley REP 20.920)
- Single use plastics law (Ley 30.884)

# Mechanical recycling

# Face mask recycling



Face mask by Oscar Cortez from the Noun Project  
Female by ic2icon from the Noun Project

During 2020, UDT was authorized by the sanitary authorities (SEREMI de Salud Biobío) to initiate the first pilot Project in Chile for face mask recycling.

A technical data sheet for the recycled material is provided with background information for the subsequent plastic processing company.



# Face mask recycling

Convenio ASIPES - UDT

## Autorización SEREMI de Salud



Chile  
en marcha

SEREMI DE SALUD REGION DEL BÍO BÍO  
UNIDAD DE GESTIÓN AMBIENTAL

EBP/chp.

A: SR. ALEX BERG GEBERT  
DIRECTOR EJECUTIVO  
UNIDAD DE DESARROLLO TECNOLÓGICO  
DE: ING. HUGO ROJAS BOUSOÑO  
JEFE DEPTO. ACCIÓN SANITARIA  
SEREMI DE SALUD REGIÓN DEL BÍO BÍO

ORD. N° 3801

ANT: Carta UDT 473/2021 solicita ampliación autorización ensayos piloto reciclaje de mascarillas.

MAT: Informa sobre autorización.

Concepción, 23 JUL 2021

Junto con saludar, en atención a oficio del antecedente mediante el cual solicita autorización para llevar a cabo ensayos pilotos para evaluar la factibilidad de valorizar mascarillas quirúrgicas desechadas por personal de empresas asociadas a ASIPES, podemos informar a Usted que revisada la solicitud, se autoriza la extensión de plazo indicado desde junio de 2021 a mayo 2022, para procesar un total de 12 toneladas de mascarillas, con el propósito de llevar a cabo los ensayos mencionados y junto con ello poder establecer de manera definitiva la factibilidad técnica y económica de la implementación de esta tecnología de revalorización de las mascarillas. El titular deberá informar el inicio y término de las pruebas, y el resultado de las mismas, notificando a esta Seremi de Salud mediante correo electrónico a [ernesto.bravo@redsalud.gov.cl](mailto:ernesto.bravo@redsalud.gov.cl)

Sin otro particular, le saluda atentamente,

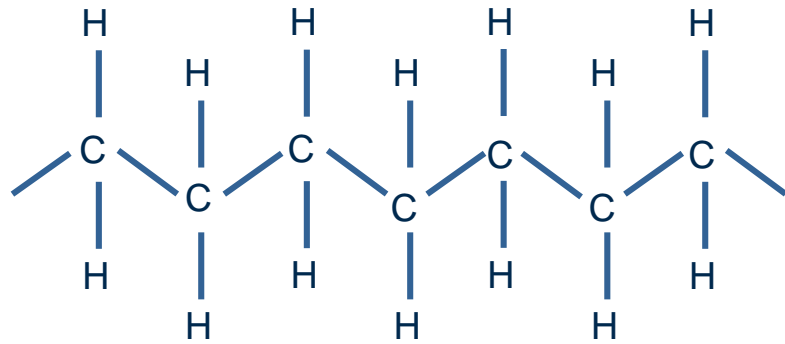
ING. HUGO ROJAS BOUSOÑO  
JEFE DEPTO. ACCIÓN SANITARIA  
SEREMI DE SALUD REGIÓN DEL BÍO-BÍO

DISTRIBUCION

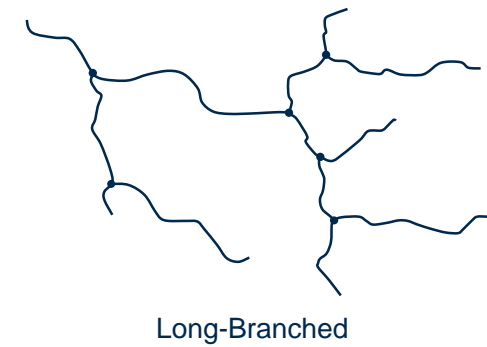
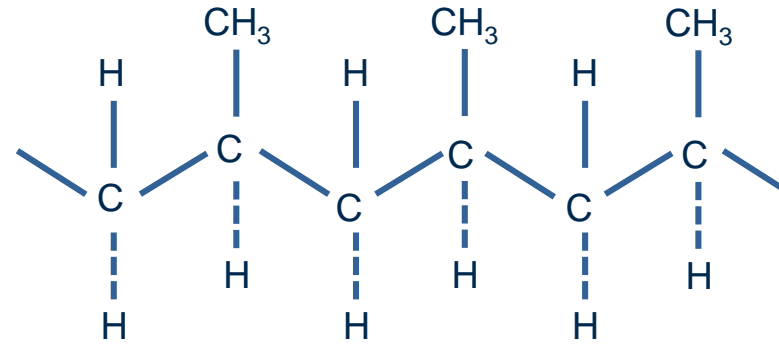
# Thermochemical recycling

# Pyrolytic degradation of polyolefins

Polyethylene



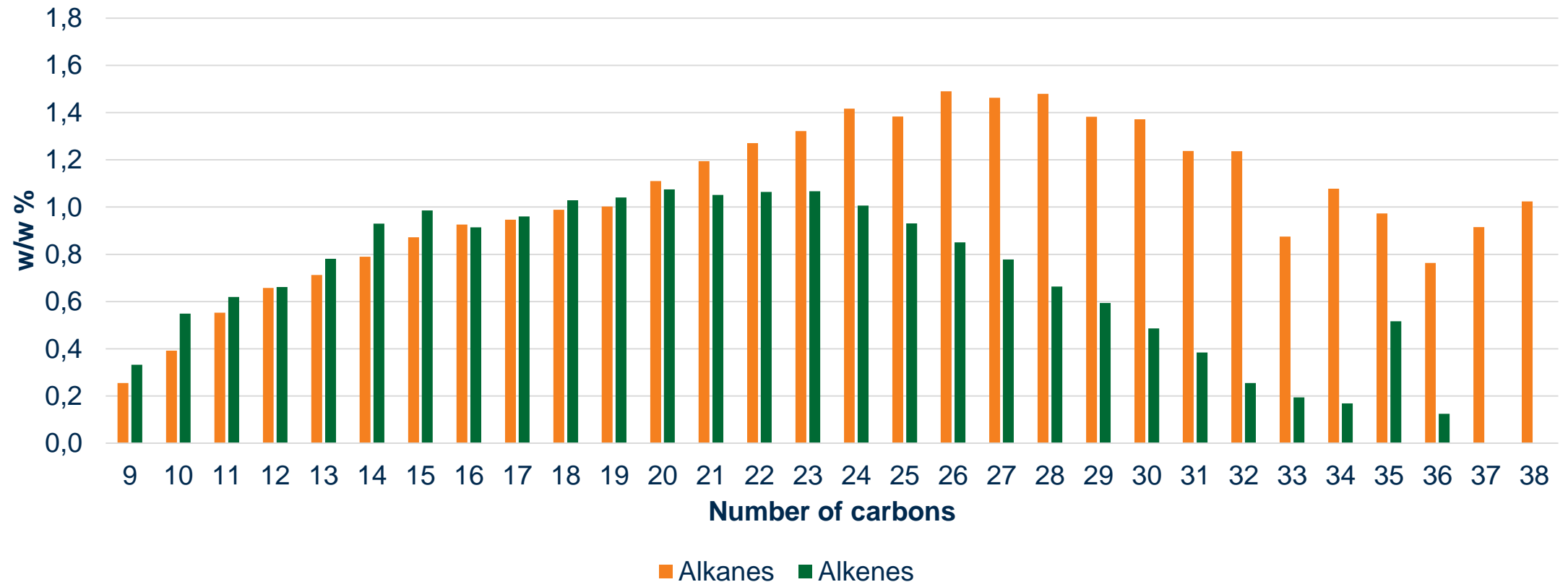
Polypropylene



# Pyrolytic degradation of polyolefins

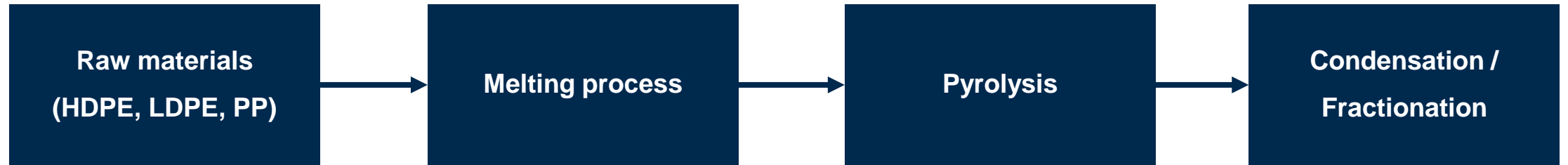
## GC pyrolytic products

Paraffin wax sample  
HDPE pyrolysis at 450 °C and 100 mbar.





# Our technology for plastic pyrolysis



## What we learnt:

- How to control thermal degradation
- To understand the importance of reaction temperature and time
- To obtain different fractions of pyrolytic products

# From the laboratory to the industrial plant

## Py-GC-MS

Mass of samples: < 1 mg

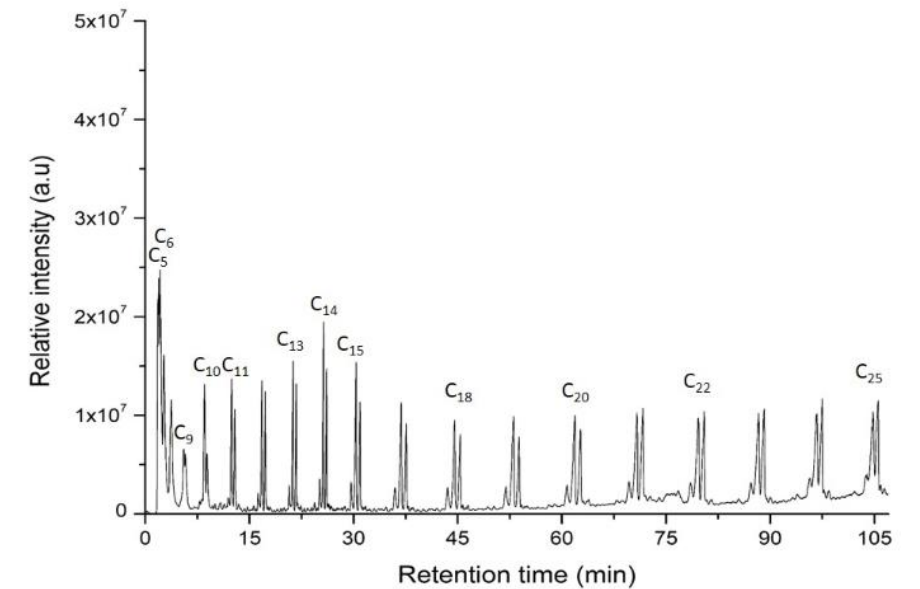
Experimental time/sample: 50-90 min

Importance:

- Understanding primary reaction mechanism
- First screening for new raw materials
- Helping to solve problems at larger scale
- First approach to find the right treatment temperature for each sample

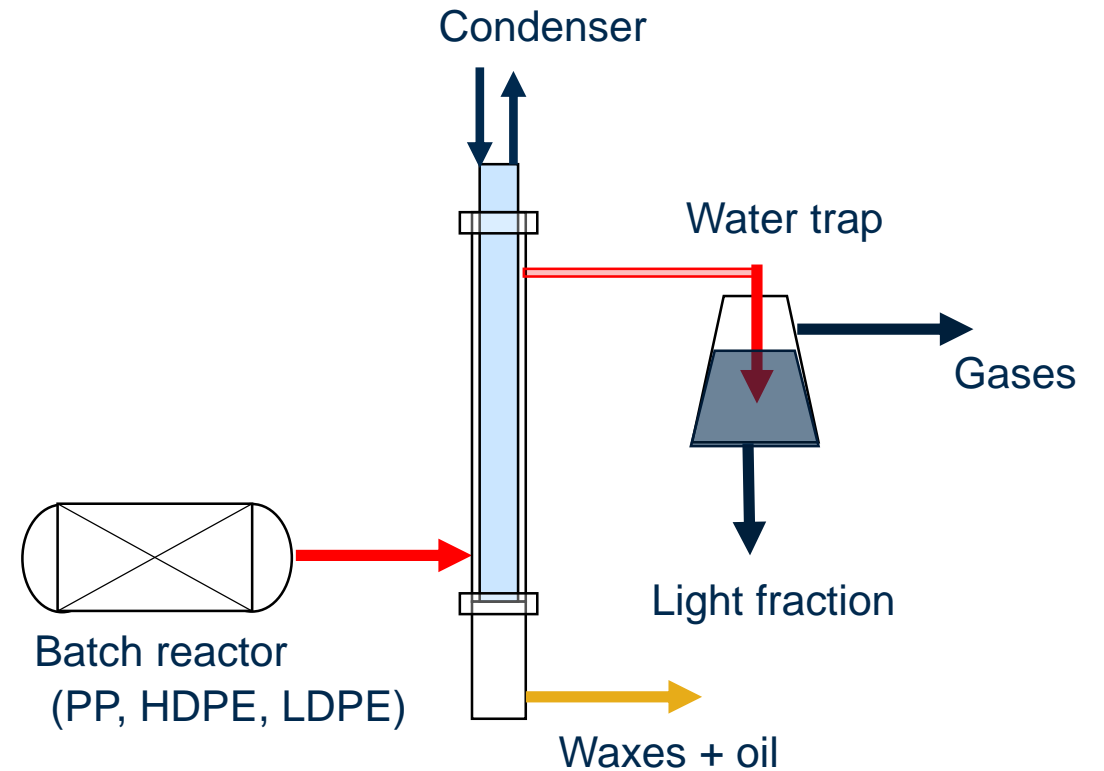


Schimadzu QP2010  
Pyrolyser Egapy 3030



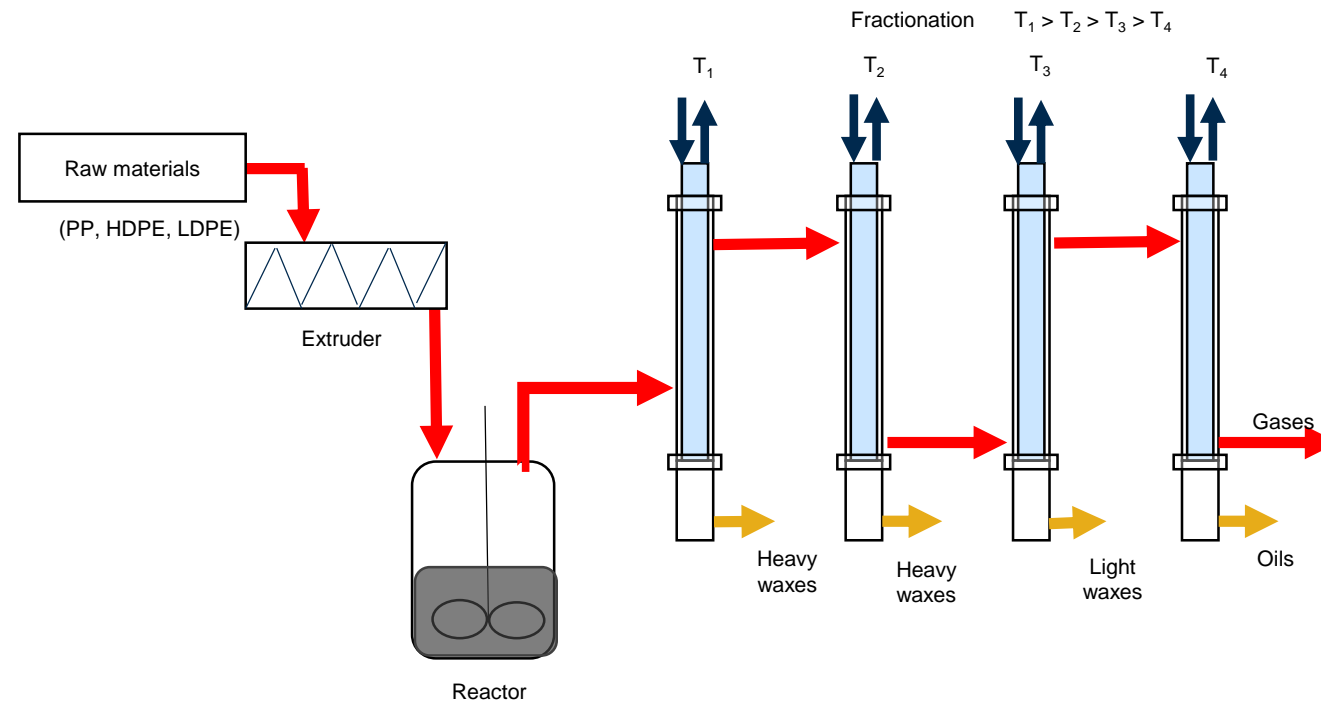
# From the laboratory to the industrial plant

## Bench scale



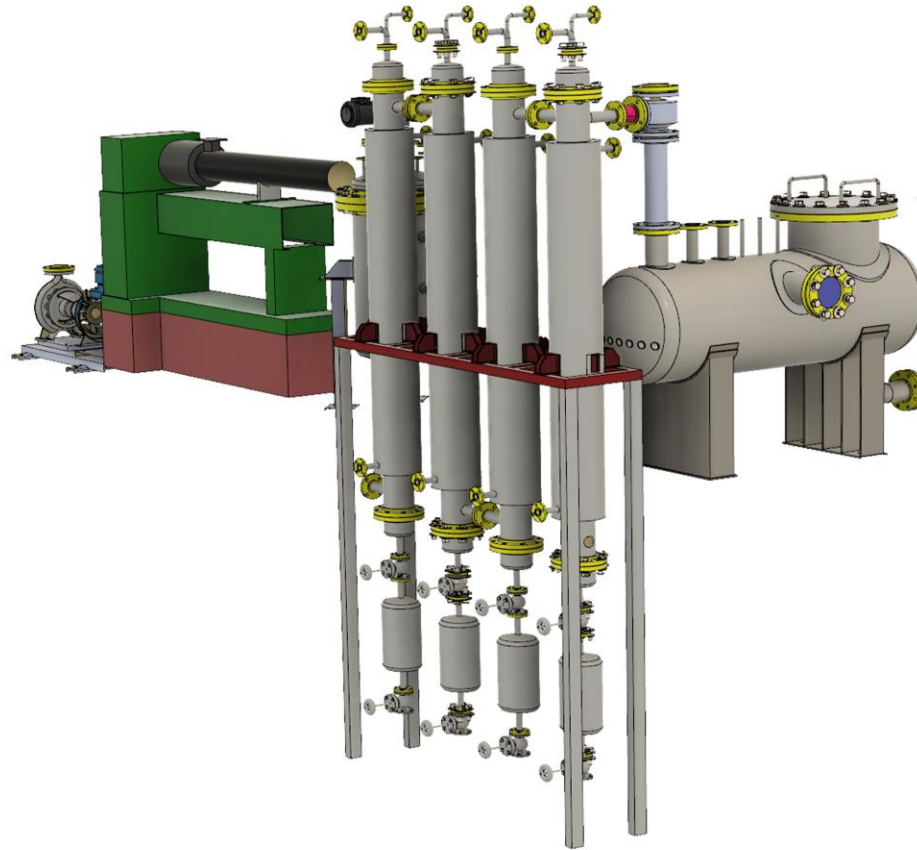
# From the laboratory to the industrial plant

## Pilot plant



# From the laboratory to the industrial plant

**Pilot plant**



# From the laboratory to the industrial plant



Pilot plant

# Products

Gases, liquids, solids



# Products and applications

## Waxes

**Hidrofobization**



**Plastic additive**





# Questions

- To what extent and within what period will we be able to substitute plastic materials?
- How can the logistic be organized?
- Small local solutions, big national solutions?
- Incentives for whom?
- What technologies are best siuted for local conditions?