
PLASTIC CHALLENGE
Hackathon 2021
EC-H2020-NONTOX FOR HACKATON 2121
Carlos Barreto, PhD
Senior Researcher /Norner Research AS /Norway
Leader Polymer Upgrade NONTOX
EU GREEN WEEK 2021 PARTNER EVENT
ZERO POLLUTION
#EUGreenWeek
for healthier people and planet
NONTOX
norner
The Polymer Explorers

OUTLINE

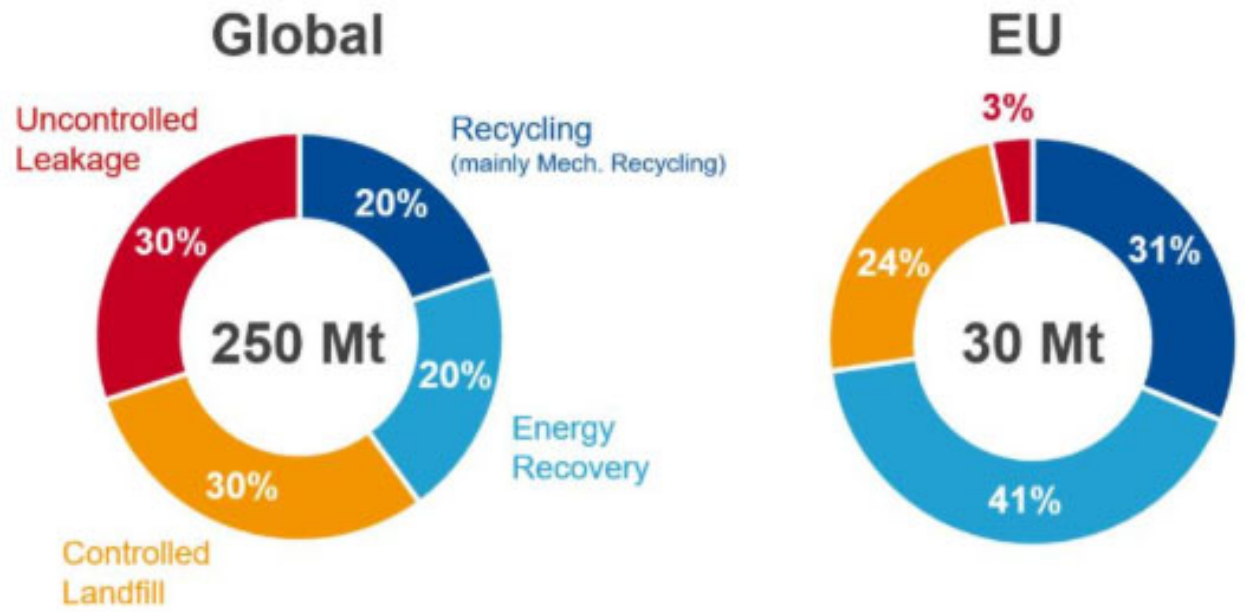
- Waste handling panorama in Europe
- The NONTOX concept
- Purification and Materials Design in NONTOX

Waste handling panorama in Europe

The NONTOX concept

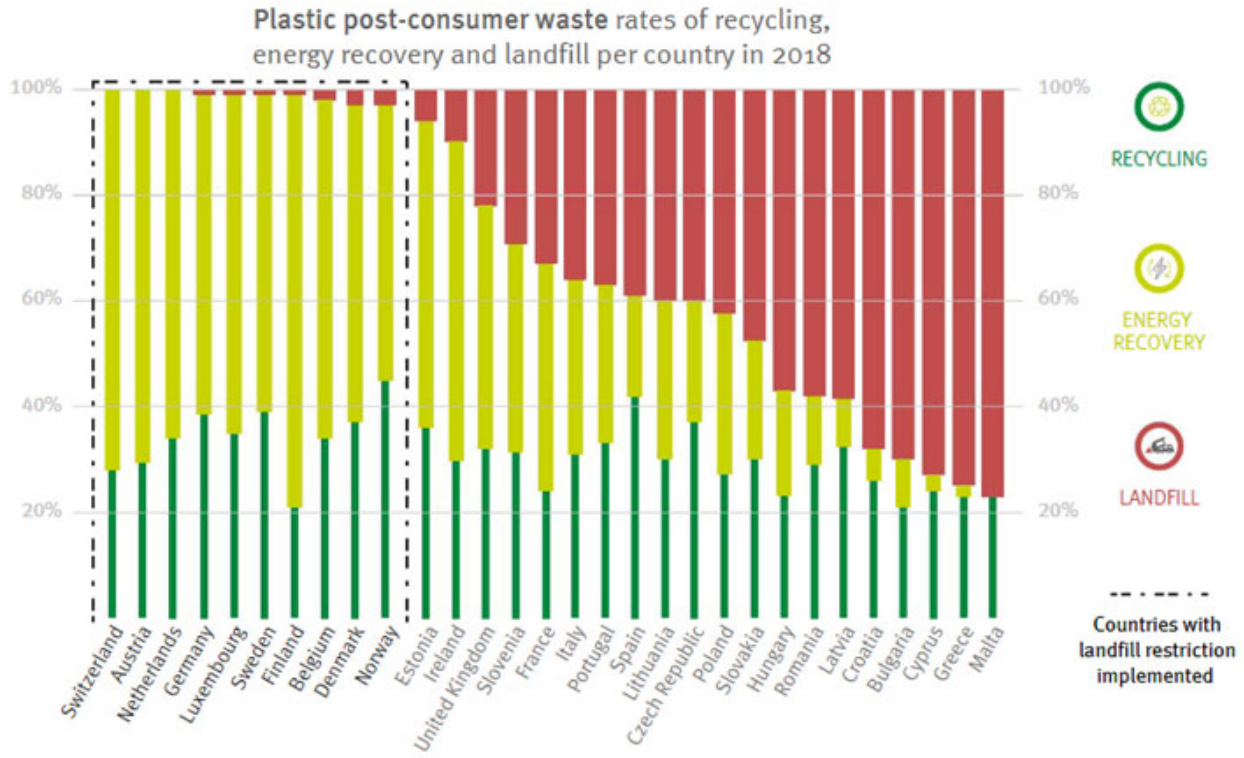
Purification and Materials design in NONTOX

Plastic Waste Landscape



From : Conversi," Summary Global Plastics Flow 2018". Feb 2020.

PLASTIC WASTE IN EFTA+UK



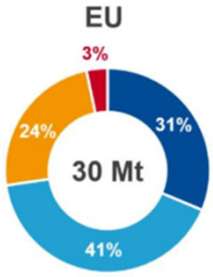
SOURCE: Conversio Market & Strategy GmbH

Plastics Europe- the facts 2020

© NORNER AS

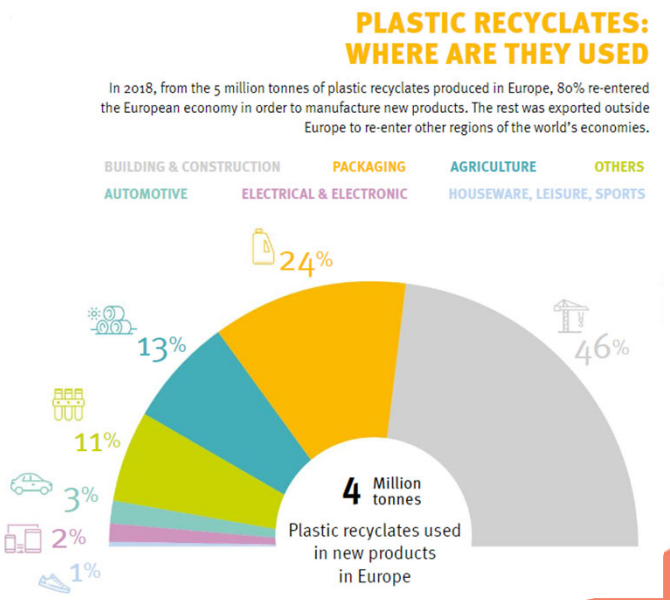
norner™ The Polymer Explorers

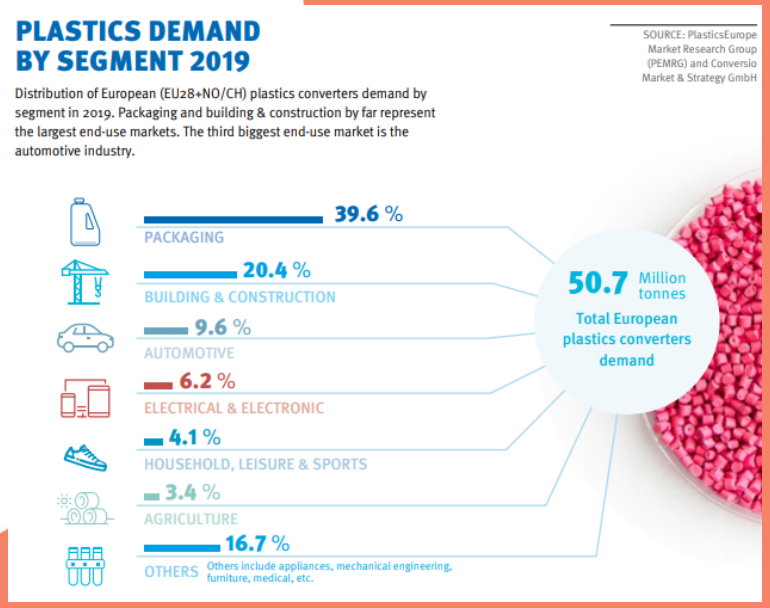
Plastic recyclates into new products



In 2019, close to ~4M were used in Products in Europe out of:
~50M put in market
~30M collected waste
~10M for recycling

SOURCE: Conversio Market & Strategy GmbH





[Plastics Europe- the facts 2020]

European Plastics Strategy 2018: Targets 10 M tones of plastic waste into products by 2025 !!

Waste handling panorama in Europe

The NONTOX concept

Purification and Materials design in NONTOX

WEEE: *Waste from electrical and elecronic equipmenyt.*

C&DW: *Construction and Demolition waste.*

ELV: *Waste from End of Life Vehicles.*

PERFORMANCE

- Design for recycling: Limited/not Existing
- Mix of polymer types (large number of plastics and variations):
  - Main technology deployed **is sorting by density**
  - Optical sorting : under development
  - Separation by solvents: under development
- Upgrading cost is an issue and demands incentives
- Varying quality in ~ Varying quality out

SAFETY

- Contamination with Hazardous Chemicals (additives, life cycle)
- About a 50% of the polymers collected for recycling in the WEEE and about 95% of the ELV streams require or may require purification in EU
- Purification by Solvents: under development
- SC (CO_2 and Solvents): under development
- Purification Cost is a major issue and demands incentives

European Plastics Strategy 2018: Targets 10 M tones of plastic waste into products by 2025 !!

H2020-NONTOX: Removing hazardous substances to increase recycling rates of WEEE, ELV and CDW plastics

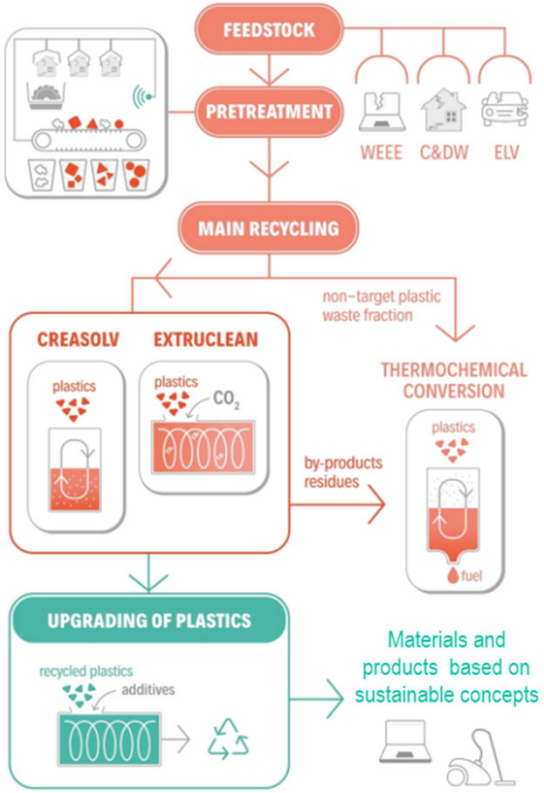


Figure 1: The NONTOX concept

NONTOX has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.820895

Norner is leading the polymer upgrade tasks

The project is coordinated by VTT and partners from seven countries complement the consortium: STENA Metall Group (SE), Coolrec (NL), Relight (IT), Galea Polymers (ES), Fraunhofer IVV (DE), AIMPLAS (ES), IMDEA Energy (ES), ERION (IT), University of Campania “Luigi Vanvitelli” (IT), Aalto University (FI) and Norner (NO)

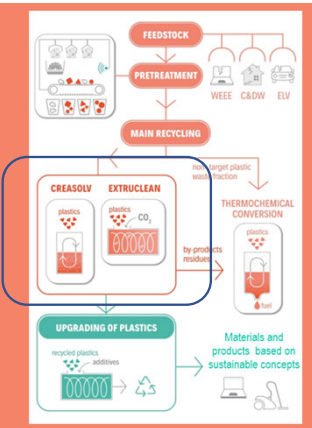
http://nontox-project.eu/

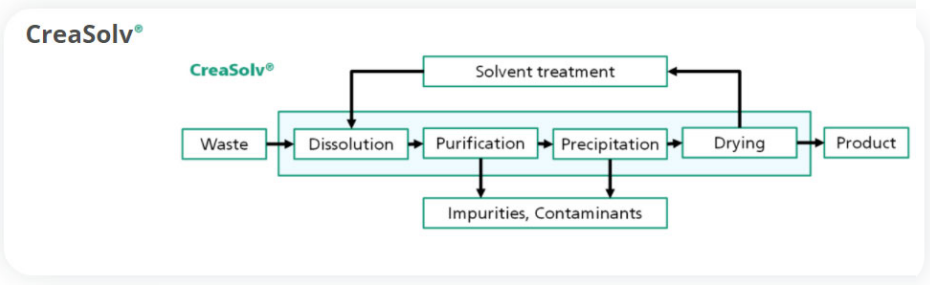
Waste handling panorama in Europe

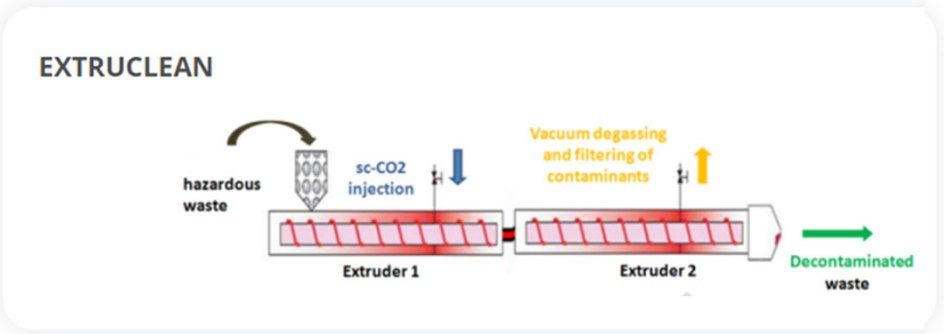
The NONTOX concept

Purification and Materials design in NONTOX

Strategy for Purification in NONTOX:







Increased mix of types

Increased contamination

Table 1 Density sorting: Practical density ranges for separation of plastics from WEEE, ELV and C&DW and NONTOX focus

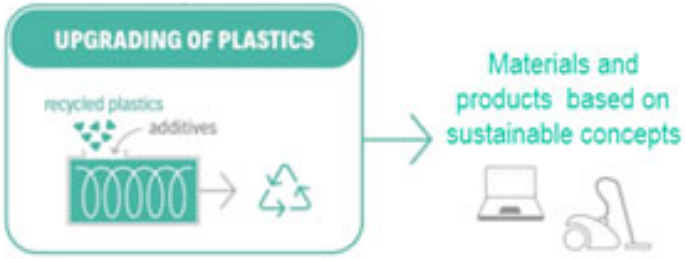
Density range (g/cm^3)	*Stream*	*NONTOX emphasis*		*Major polymers in the stream*	*Targets for Purification*
		EXTRUCLEAN	*CREASOLV*		
<1.0	A			**POLYOLEFINS** - PP, PE and versions with low levels of filler and reinforcing fibers	PP/PE, PE, PP
1.0-1.1	B			**STYRENICS** - ABS (low Br), PS &HIPS (low Br), filled and reinforced polyolefins	ABS, HIPS/PS
1.1-1.25	C			ABS (high Br), PS &HIPS (high Br), PC, PC/ABS, PA, soft PVC, PMMA. Filled and reinforced polyolefins and styrenics	ABS, HIPS, PC
>1.25	D			Hard PVC and other high density and highly filled polymers	

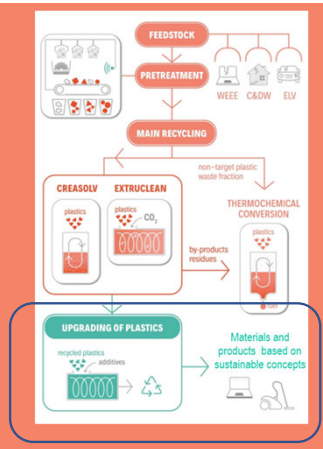
A, B : Monomaterial streams (>90% of one polymer type)(typically not hazardous)
C, D : Mixed streams (typically most contaminated)

CREASOLV focus on highly contaminated streams

EXTRUCLEAN focus on removal of VOCs

Focus of plastics upgrade in NONTOX:





- Departing from decontaminated / non-hazardous monomaterial streams
- Material Development (TRL 4-6) towards sustainable concepts & performance:
  - Design ***from*** Recycling
  - Simultaneous Purification & Conversion (TRL3)
  - Circularity enabled by CREASOLV (PC, PC/ABS)
  - Design ***for*** Recycling (focus on density separation):
    - Focus to fit to Shredding /density sorting (polyolefins & styrenics)
    - Monomaterials:
      - Single, multilayer
      - Self reinforced composites

Table 1 Density sorting: Practical density ranges for separation of plastics from WEEE, ELV and C&DW and NONTOX focus

Increased mix of types

Increased contamination

Density range (g/cm^3)	*Stream*	*NONTOX emphasis*		*Major polymers in the stream*	*Targets for Purification*
		EXTRUCLEAN	*CREASOLV*		
<1.0	A			**POLYOLEFINS** - PP, PE and versions with low levels of filler and reinforcing fibers	PP/PE, PE, PP
1.0-1.1	B			**STYRENICS** - ABS (low Br), PS &HIPS (low Br), filled and reinforced polyolefins	ABS, HIPS/PS
1.1-1.25	C			ABS (high Br), PS &HIPS (high Br), PC, PC/ABS, PA, soft PVC, PMMA. Filled and reinforced polyolefins and styrenics	ABS, HIPS, PC
>1.25	D			Hard PVC and other high density and highly filled polymers	

A, B : Monomaterial streams (>90% of one polymer type)(typically not hazardous)
C, D : Mixed streams (typically most contaminated)

List of Demonstrators & Material Concepts

DM#	Responsible Compound Formulation	Processing Small Scale	Demo pilot scale	Target TRL	Demonstrator	Sustainable Material Concepts	Application
DM1	NOR	NOR	NOR	6	Vacuum Cleaner Base	• CE friendly materials • Monomaterial multicomponent • Multilayer Monomaterials ABCBA • SRPOs • High efficiency fillers • Simultaneous processing and purification • Circularity of PC/ABS • Food contact parts from recycling	Target: E&E Appliances Also for: Automotive
DM2	VTT	AIM (2K comp, Adhesion)	NOR	6	Shaving Machine Cover		Target: E&E Appliances Also for: Automotive
DM3	VTT	AIM	NOR	6	Refrigerator Liner		Target: E&E Appliances
DM4	NOR	NOR	-	4	Rotomoulded Item [e.g. fuel/septic tanks]		Applicable to: B&I Automotive
DM5	AIMPLAS	AIMPLAS (XT+3DP)	-	4	3D Printing Item [Multipurpose]		Applicable to: Consumer goods
DM6	NOR	NOR	-	3	Foamed products [e.g. HP Insulation]		Applicable to: B&I
DM7	ALLTO/NOR	AAL	-	4	Multipurpose laminates [e.g. Hockey protection equipment]		Applicable to: Consumer goods

Follow http://nontox-project.eu/ for interesting results in the coming 18 months !

Thanks for Listening! ☺

Role in Norner : Senior Researcher, *PhD*

Role in NONTOX: WP Leader Upgrading of Plastics

E-mail Address: carlos.barreto@norner.no

Phone: +47 9416 1831

Expertise: **Composite Materials, Compounding, Circular Economy**

CARLOS BARRETO

http://nontox-project.eu/

https://www.norner.no/