OCEAN WISE

Reducing EPS marine litter in the North East Atlantic

State of art of EPS / XPS raw materials and their alternatives, associated process and products

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Seabird

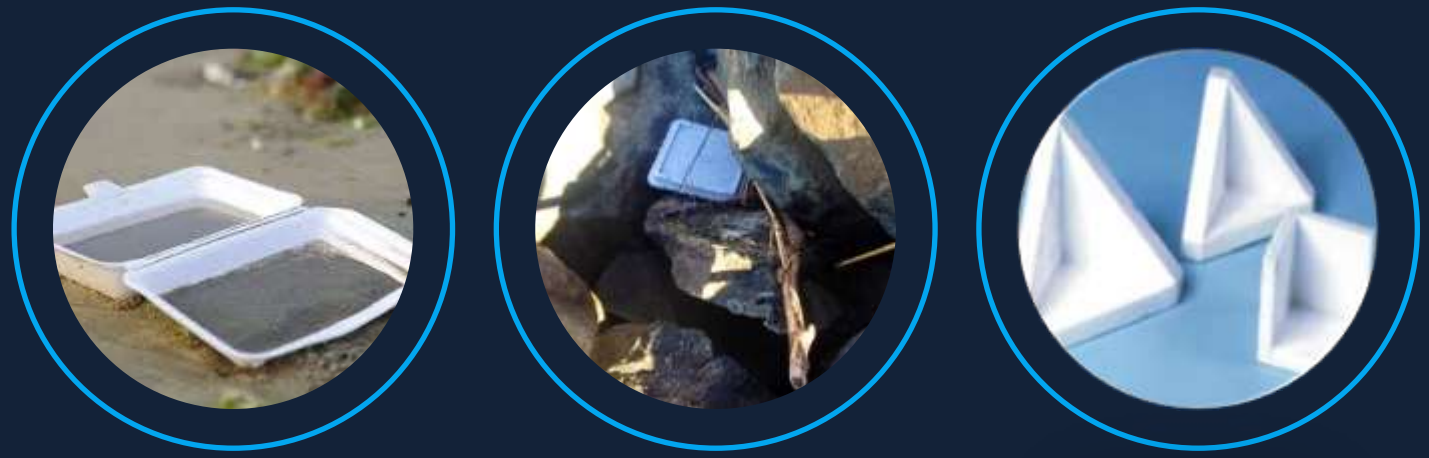
WORKSHOP #4
20 October 2021

Interreg Atlantic Area
European Regional Development Fund

EUROPEAN UNION

SUMMARY

- State of art of EPS and XPS raw materials
- Associated process and product
- State of art of alternatives



From petrobased (or biobased) to polystyrene polymer

Storax

Benzoin

Oil

Light hydrocarbons

- by distillation (cf 1)

Major intermediate in base chemicals

Ethylene / Benzene

- by steam cracking (cf 2)
- by extraction process (cf 3)

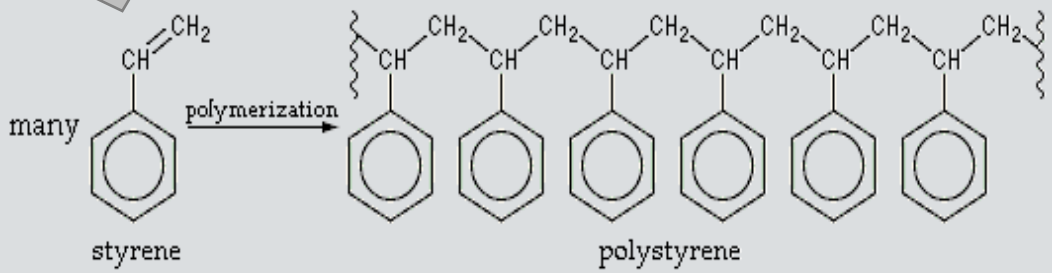
Ethylbenzene

- by alkylation (cf 4)

Styrene

- by dehydrogenation (cf 5)

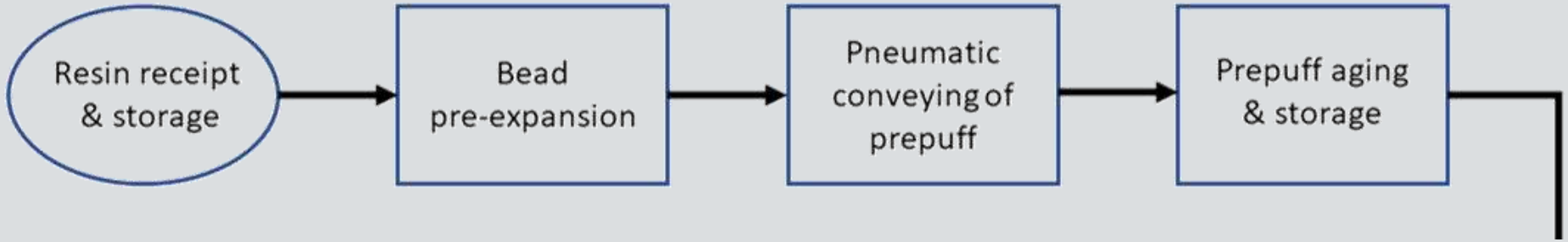
1) Synthesis of styrene

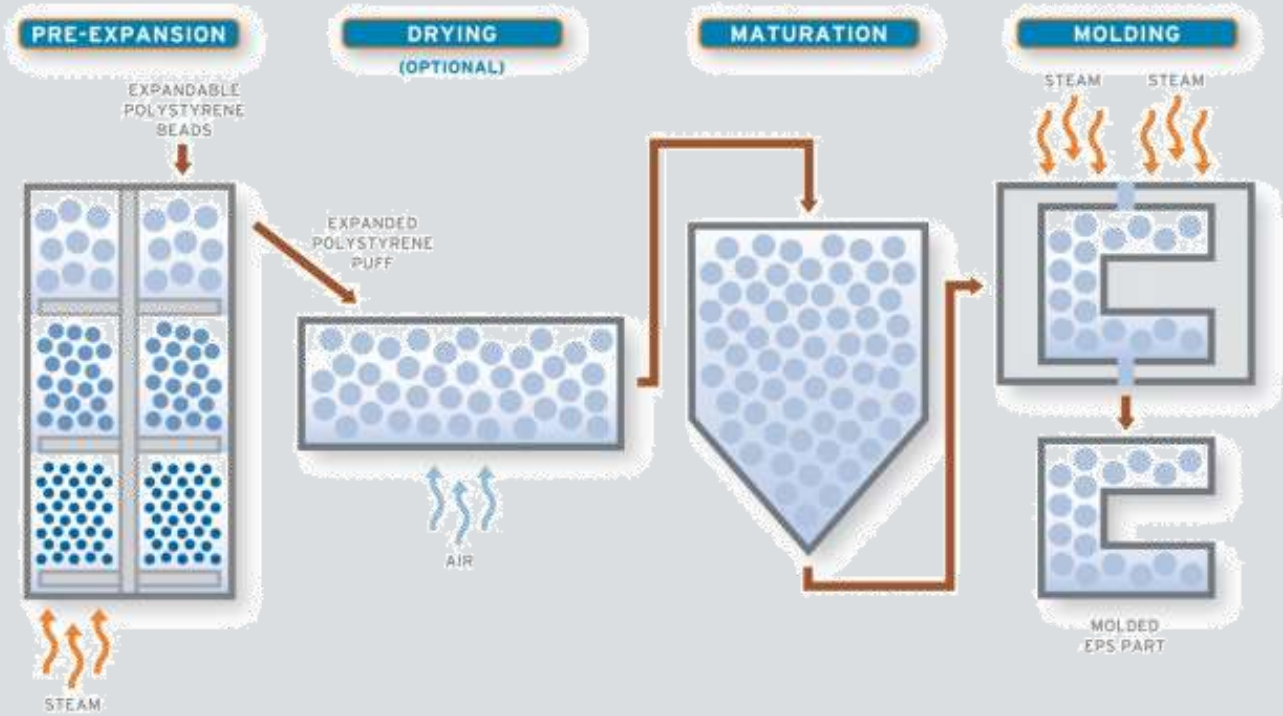


2) Polymerisation of styrene

3) Polystyrene pellets

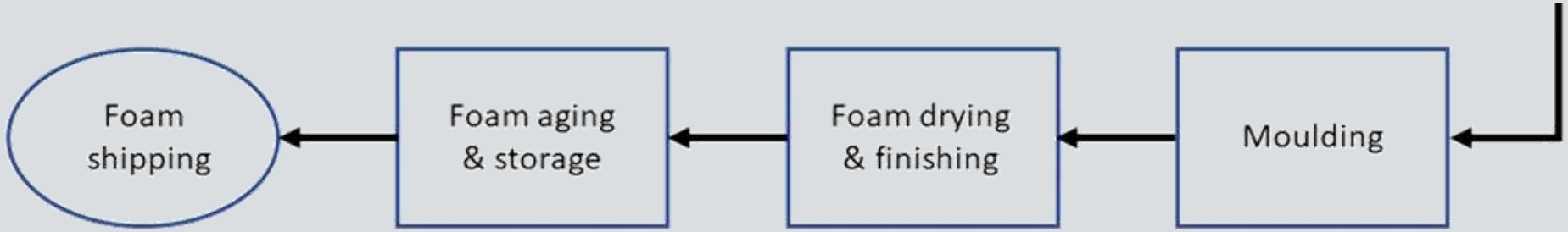
1) FROM RAW PS BEADS TO EXPANDED EPS BEADS

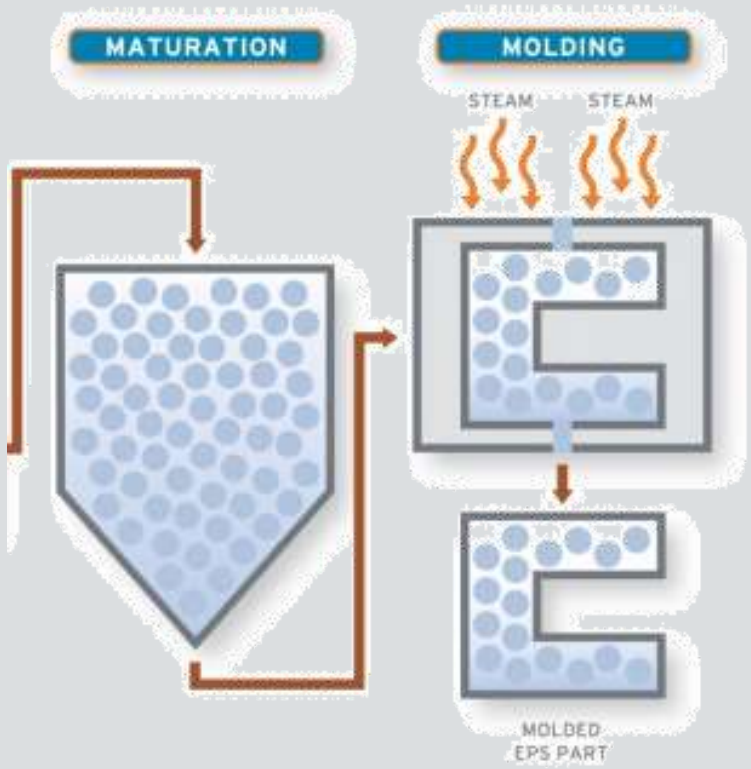




Expansion of polystyrene beads

1) FROM EPS BEADS TO MOULDING PRODUCTS





EPS

1) EPS USED IN MANY APPLICATIONS

Insulation

Flotation

Construction fill in

Recreation

Transport of fragile goods

Transport of food

Serving of food

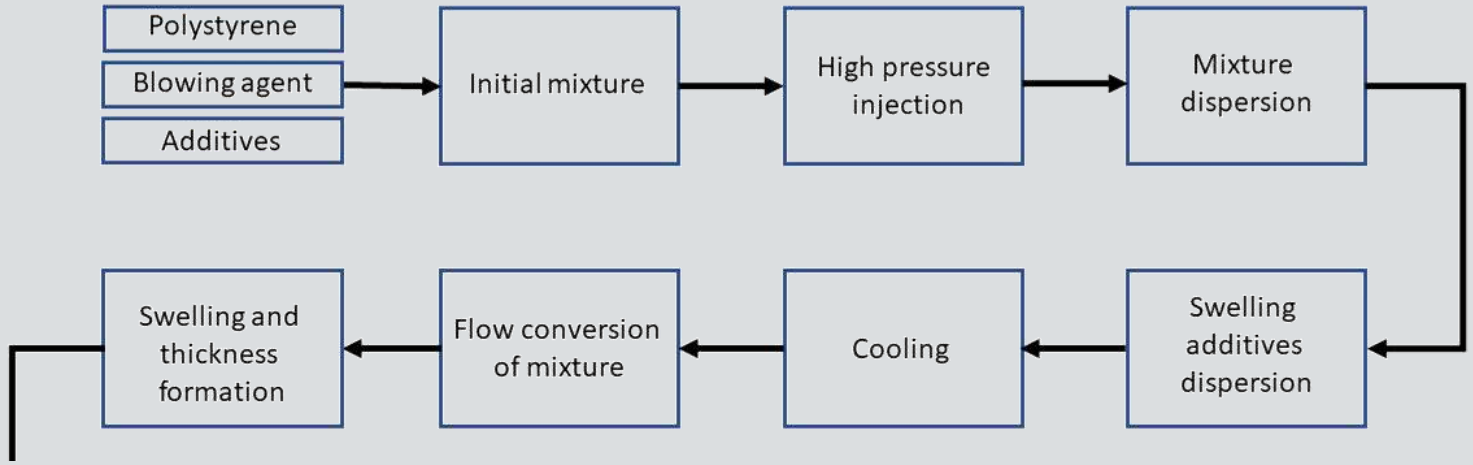
Personal protective equipment

Agriculture

Why used EPS ?
For many properties :

- Mostly composed of air
- Lightness
- With high thermal insulation qualities
- Waterproof
- Strong
- Durable
- With high compressive strength
- With block rigidity
- Easily moulded in different shapes

2) FROM RAW PS BEADS TO XPS COMPOUNDS



PS Beads

Blowing agents

Additives

XPS

Formulation of extruded polystyrene beads

FROM XPS COMPOUND TO EXTRUDED PLATES PRODUCTS

XPS extrusion plate/sheet process

Insulation

Serving of food

Why used XPS ?
For the same properties :

- Mostly composed of air
- Lightness
- With high thermal insulation qualities
- Waterproof
- Strong
- Durable
- With high compressive strength
- With block rigidity
- Easily moulded in different shapes

ADDITIVES USED IN EPS / XPS

Substance	Function
Bis (2-ethylhexyl) phthalate (DEHP)	Plasticiser
Dibutyl phthalate (DBP)	Plasticiser
Benzyl butyl phthalate (BBP)	Plasticiser
Diisobutyl phthalate (DIBP)	Plasticiser
Acrylamide (monomer)	Intermedia – Co-monomer
Hexabromocyclododecane (HBCDD)	Flame retardant
Lead chromate	Pigment
Lead chromate molybdate sulfate red	Pigment
Lead sulfochromate yellow	Pigment

And others subtances listed in OW database …

OceanWise works on a database with some information of each additives founded in EPS / XPS (name, properties, CAS number, Hazard classification, food contact, properties of concern, how to use it safely) and sometimes alternatives

Additives name	Properties	Applications	CAS Number	EC / List no	Hazard classification & labelling	Properties of concern	How to use it safely	Food contact	Alternative

PRODUCTS TARGET IN OCEANWISE PROJECT

Aquaculture and fisheries market

Food / No food market

Single use plastics *(Directive (EU) 2019/904)*

STATE OF ART OF ALTERNATIVES

Overview of different solutions/ suppliers

Material	Picture	Location	Comment
Foamed PLA		Scion Univ New Zealand	The resulting PLA foam looks and performs much like polystyrene with similar insulation and mechanical properties
Mushroom		Ecovative Mushroom USA	Method of growing a mushroom-based insulation
PLA		BioPak Australia & New Zealand	BioPak has been a pioneer and leader in the field of sustainable single use food service disposable packaging in Australia and New Zealand

STATE OF ART OF ALTERNATIVES

Overview of different solutions/ suppliers

Material	Picture	Location	Comment
Foamed PHA		Kaneka Japan	Development of a biobased and biodegradable foam, will degrade into water, CO2 and biomass by micro-organisms.
Wool and wood		WooBox Serbia	Made out of wood and naturally processed wool, the WooBox is intended to be used to transport all sorts of fresh food, aiming to eventually become a key element of the food delivery industry (temperature controlled logistics).
PLA		Vegware UK & USA	Vegware uses a variety of renewable plant-based materials to manufacture our product range. In its finished form, Vegware packaging is compostable in commercial facilities, where accepted.

STATE OF ART OF ALTERNATIVES

Overview of different solutions/ suppliers

Material	Picture	Location	Comment
Origo + Polypropylene		Cornware UK	Not BIOPLASTIC because 30% PP / 70% yarn starch
Unknow material		Thai Healthy (Ireland)	First restaurant chain to use 100% compostable packaging
Wood paste + Nanocellulose + Polyvinylic alcohol		Washington Univ (USA)	The plant-based material has surpassed the insulating capabilities of polystyrene foam. It is also very light and can support up to 200 times its weight without changing shape. It breaks down well and its combustion does not produce polluting ash.

STATE OF ART OF ALTERNATIVES

Overview of different solutions/ suppliers

Material	Picture	Location	Comment
Sheep's wool + cardboard		Woolcool UK	Woolcool insulation is made using 100% pure sheep's wool. The Wool is sustainable, compostable, and due to Wool's superior insulative properties, more effective than other solutions at keeping contents consistently colder for longer.
Polypropylene 100% recyclable		Tri-pack UK	Replace EPS by PP 100% recyclable
Recycled paper and AKD (Alkyl ketene dimer)		RE-COOL (by Igloo) USA	Made from recycled paper and AKD (Alkyl ketene dimer), a natural component that waxes and binds the paper pulp for stability and waterproofing Retains ice for up to 12 hours and water for up to 5 days; can be reused—simply empty the water and air dry the cooler

EPS/XPS Alternatives focus

- Similar format to EPS so comparable : Oceanwise Calling Award !

SeaClic Box, a design focus on user :
The lid is clipsable avoiding the use of straps.
For fish wholesalers, it limits the waste and the cost due to these straps, it also remove the cost linked to the sealing machine for straps.

This consommable reduction also helps to improve the SeaClic Box global environmental impact and prevents any risk of non compostable material introduction in the composters.

- No alternative for XPS, if you have information we are listening to solutions
Samples is under development in laboratory scale
  - Alternative of XPS with alternative bioplastic foamed plates / sheets

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Thank you for your attention !

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