ChemPET technology solutions for textile recycling

Presentation outline

- ChemPET solution for Textile recycling
- A challenge
- The problem (2)
- The solution
- PU & heavy color removal
- The whole process

Textile recycling – a challenge

The first hurdle in the textile waste recovery is the **sorting,** having the goal to get at least 70% polyester in the sorted garment destinated to the chemical recycling.

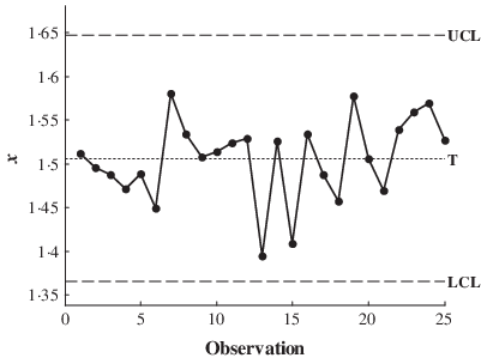
After the sorting of the waste, its preparation, i.e. to make it suitable for the chemical recycling, might be expensive.
The most of the depolymerization reactor cannot be fed with bulky/low density waste, like fabric, film and foam. **This Feedstock need to be converted in free-flowing granules with an higher density**

Textile recycling –
Hard point removal & compaction: the problem (1)

Hard parts, such as metallic buttons and zippers, can damage the agglomerators. Currently, most technology providers rely on manual removal of these unwanted parts or on shredding and subsequent optical sorting separation. In both cases **an important fraction of the textile material is lost** with a strong yield reduction and high disposal cost

Energy consumption of the agglomeration process: upfront a production of 1.5 t/h the installed power is 800kW, according to the supplier of the equipment. For a 50kton/y plant the **installed power would be 3.3MW only for the compaction process step.** The cost of the EE in energy in Italy is presently 0.35€/Kwh (average yearly price) that correspond to a process cost, only for the agglomeration, of 184 €/ton.

Textile recycling –
Hard point removal & compaction: the problem (2)



A problem given by the agglomeration is the **risk of thermal degradation**: care must be taken to ensure that the product does not thermally degrade. Garbo has experienced worsening B value of the final monomer/polymer

An additional drawback of the agglomeration process is the **consistency of the process control in the glycolysis reactor.** Garbo has tested several tons of shredded and agglomerated post consumer textile waste and the outcome is that the **glycolysis reaction time of the compacted material changes because of the change of the thickness** of the agglomerated feedstock over the time. This can cause an incomplete depolymerization of the waste and the production of unreacted pet/oligomer can cause **a significant loss of productivity**.

The agglomeration looks to be a reliable process for an extrusion but not for a depolymerization process due to the thickness variation of the granules.

Textile recycling –
Hard point removal & compaction: the solution

ChemPET has made intensive tests on its continuous depolymerization reactor, **feeding shredded uncompacted textile waste with hard contaminants (metallic zips and buttons)**. It has been proven that it's possible to feed any bulky feedstock, keeping under control the feed rate and the reaction time, that is short due to the thickness of the yarn. Hard and heavy contaminants are collected in a specific trap of the reactor and can be sold to the metallurgical industry.

ChemPET has also tested textile waste containing polyolefinic stretchable yarn. Sample composition was : 78% PET, 22% Xlance fiber. The polyolefinic Xlance material does not participate in the glycolytic reaction and can be easily separated in our patented glycolysis reactor in the same way the POs from packaging are removed

Textile recycling – PU & heavy color removal

Waste sample
Black & heavily coloured PU/Polyester WASTE

New Process Development

BHET

White crystals
COLORIMETRIC ANALYSIS
L = 98.58
a = - 0.18
b = 1.47

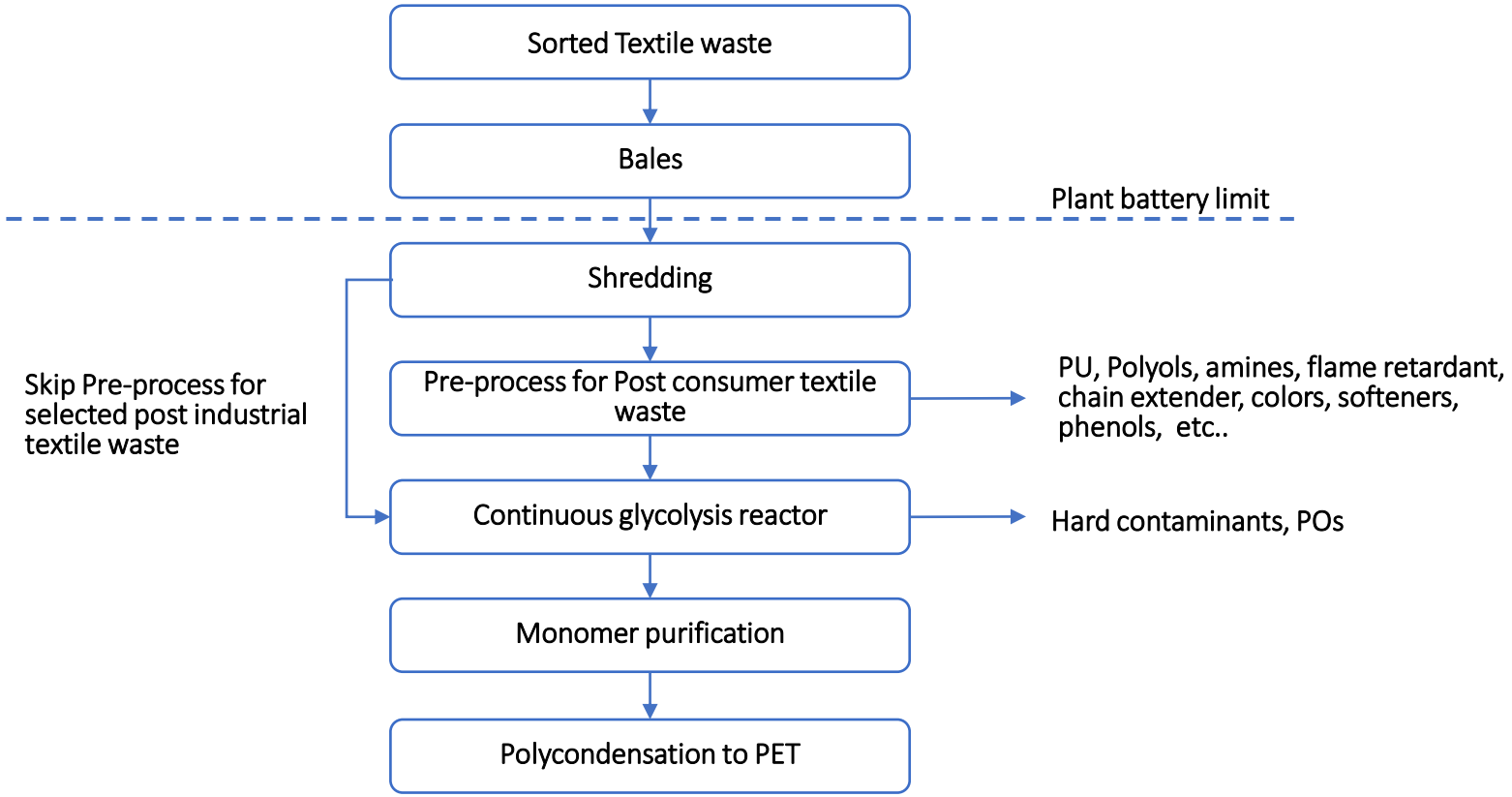
SPECTROPHOTOMETRIC ANALYSIS
λ= 475; A=0.014
λ= 510; A=0.008
λ= 570; A=0.007
λ= 590; A=0.006
λ= 650; A=0.003

ATOT= 0.038

rPOY
100% Recycled Polyester Oriented Yarn

ChemPET has developed a new process step to use as feedstock **heavily colored and PU contaminated polyester textile waste**
The purity and colorimetric values of the BHET fall within the required specifications. A white Polyester Oriented Yarn is obtained

Textile recycling – the whole process



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