



Suitability and identification of textile waste as a raw material for different processes

Taina Kamppuri

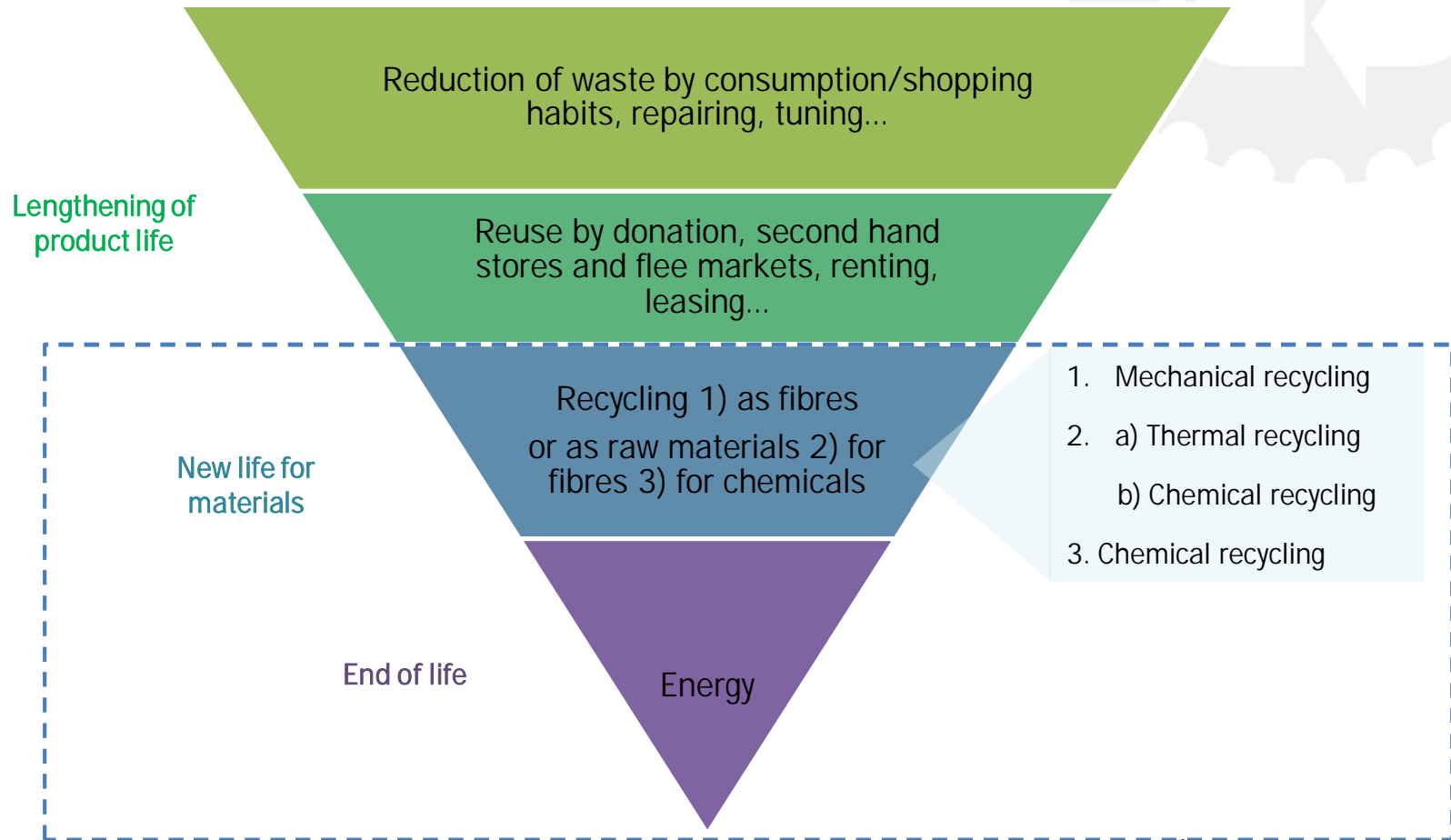
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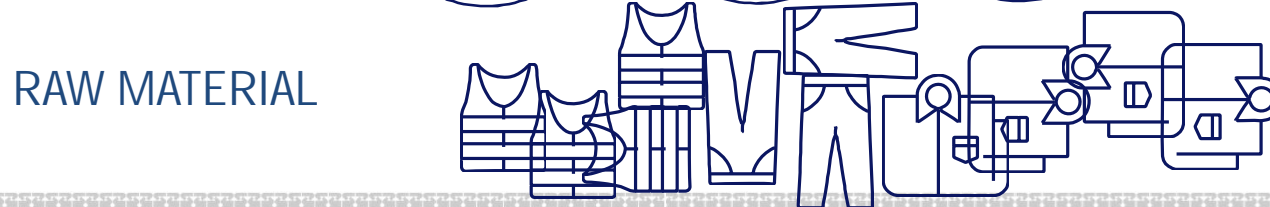
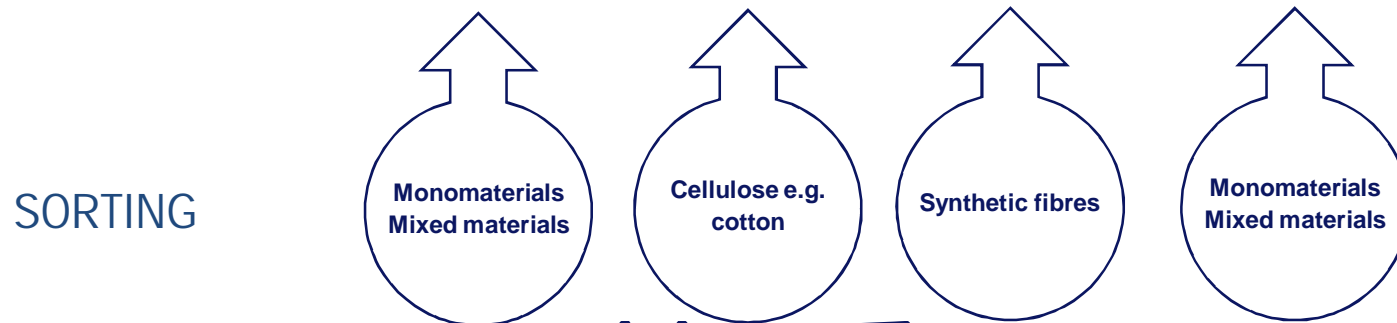
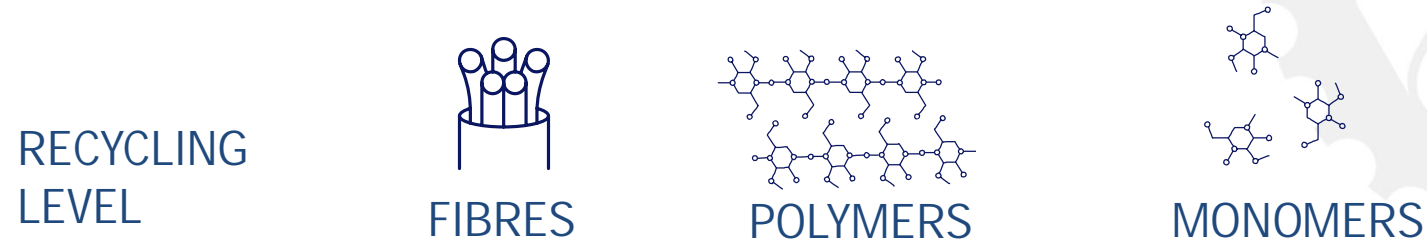
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Scope

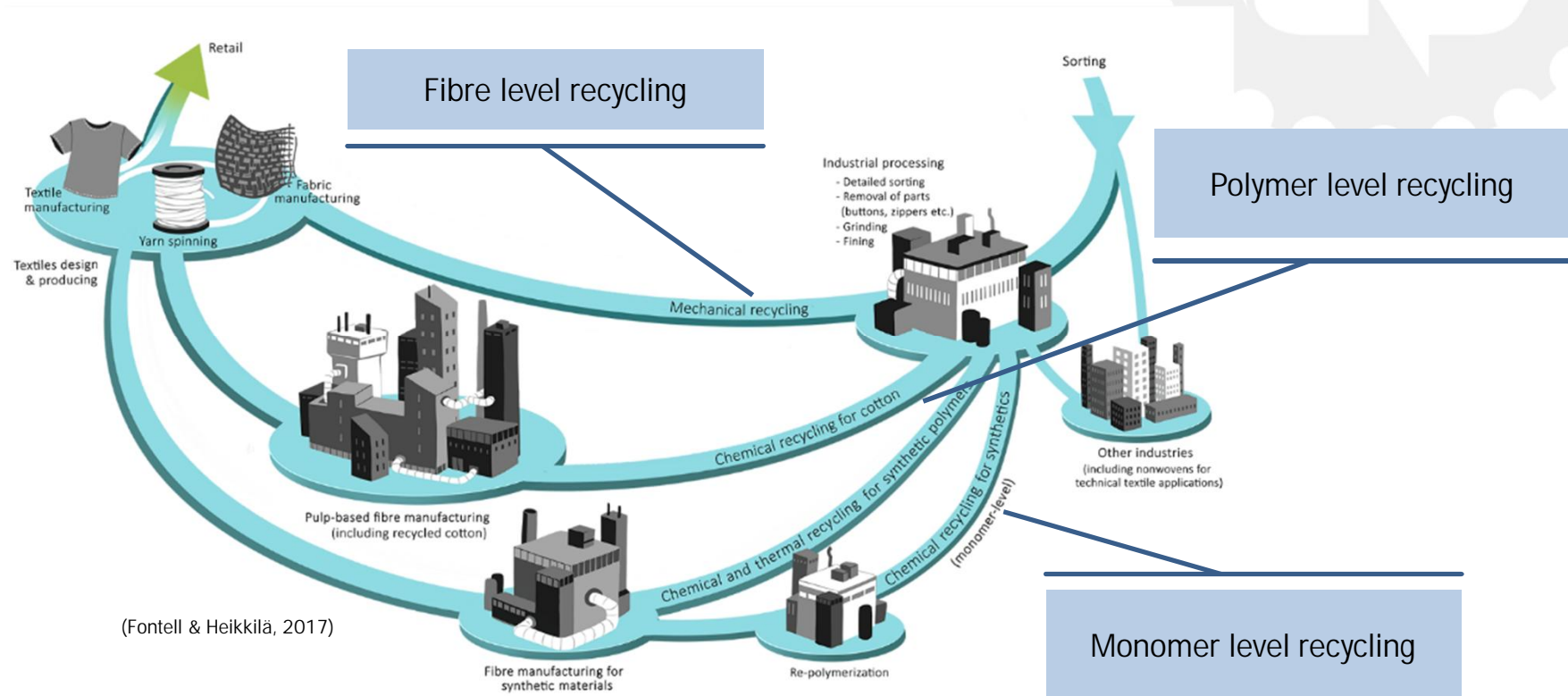
in context of adopted waste hierarchy and textiles



Textile waste as raw material



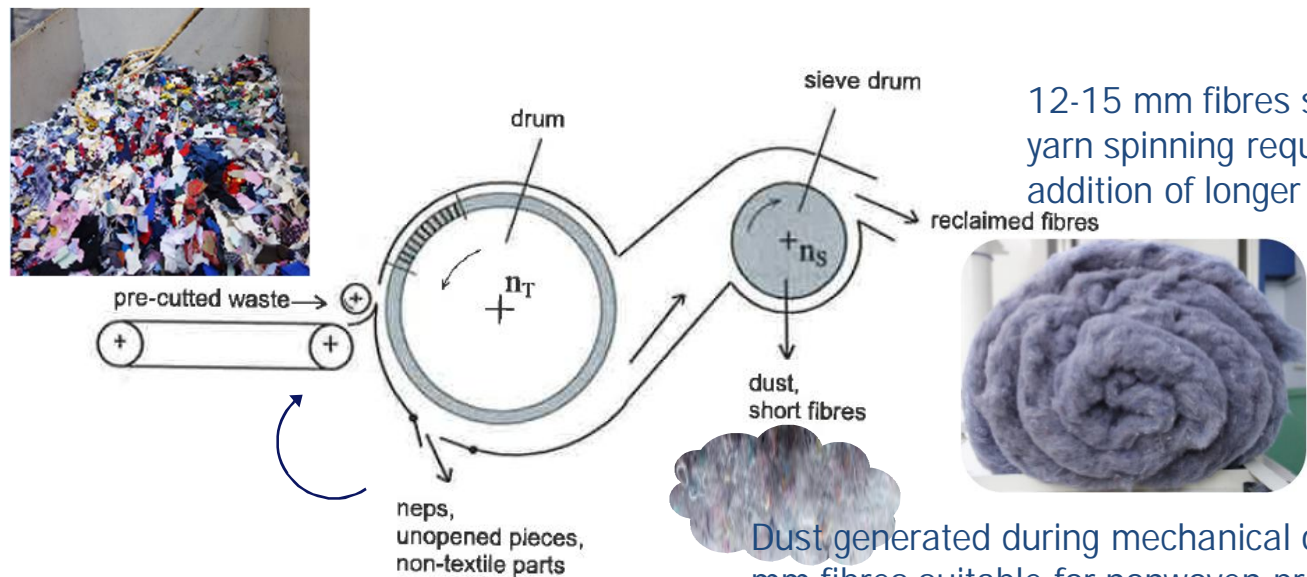
Textile-to-Textile Recycling



Recycling as fibres



- Mechanical recycling process
 - Suitable for pure materials and mixed materials
 - Not suitable with materials with high elastane content, coated materials



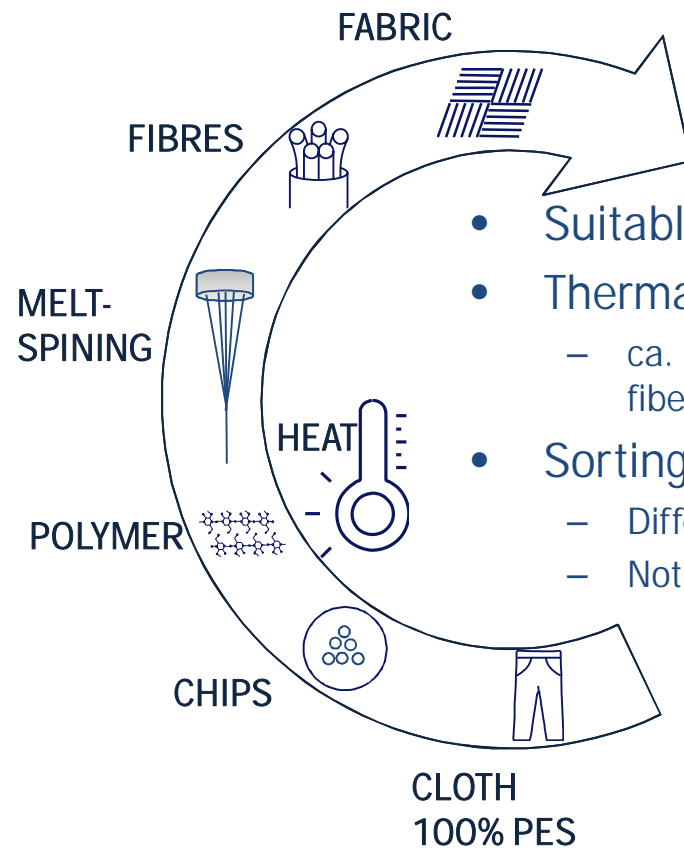
12-15 mm fibres sufficiently long to meet yarn spinning requirements, but often needs addition of longer fibres

Dust generated during mechanical opening i.e. 1-5 mm fibres suitable for nonwoven processes where fibre web is formed with air laying, wet laying and foam laying

Ref. Albrecht, Wilhelm, Hilmar Fuchs & Walter Kittelmann 2013. *Nonwoven Fabrics*: Weinheim: Wiley_VCH Verlag GmbH & Co. KGaA.

Recycling as polymers

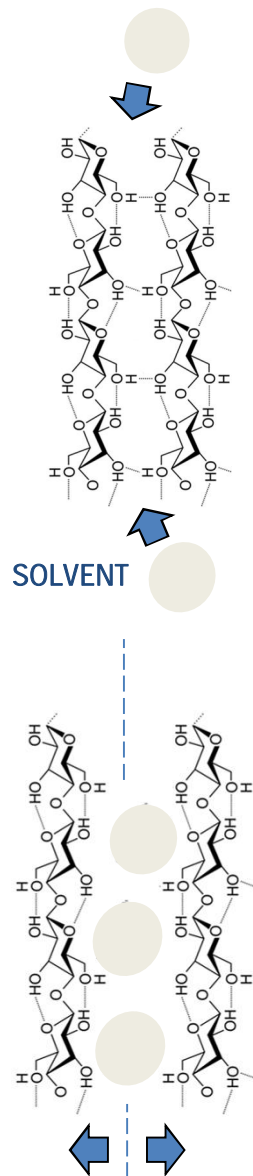
Thermal recycling of synthetic fibres



- Suitable for polymers that can be melt processed
- Thermal recycling is commercially available
 - ca. 40% of used PET bottles are thermally recycled into textile fibers
- Sorting of the starting material essential
 - Different synthetic fibres have different thermal properties
 - Not suitable for natural fibers

Recycling as polymers

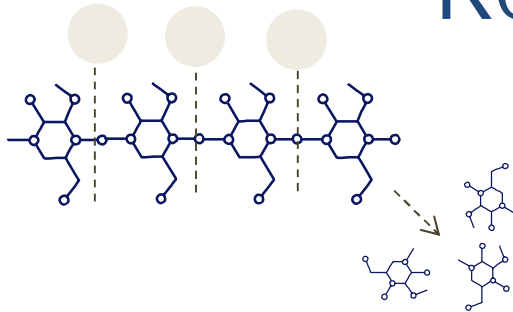
Chemical recycling



- Suitable for polymers that need to be dissolved in a solvent before spinning is possible
 - e.g. cotton, PAN
- Solvent cuts the bonds between molecular chains
- Chains can be regenerated **back to textile fibres** by the wet spinning method
- Sorting is essential
 - Dissolution behavior of different materials is different

Recycling as monomers

Chemical recycling



- Polymer chains are cut to monomers by chemical means
- Commercially available for polyester and polyamide textiles

- Accurate sorting is essential
- Refining steps before and after
 - removal of color
 - removal of impurities

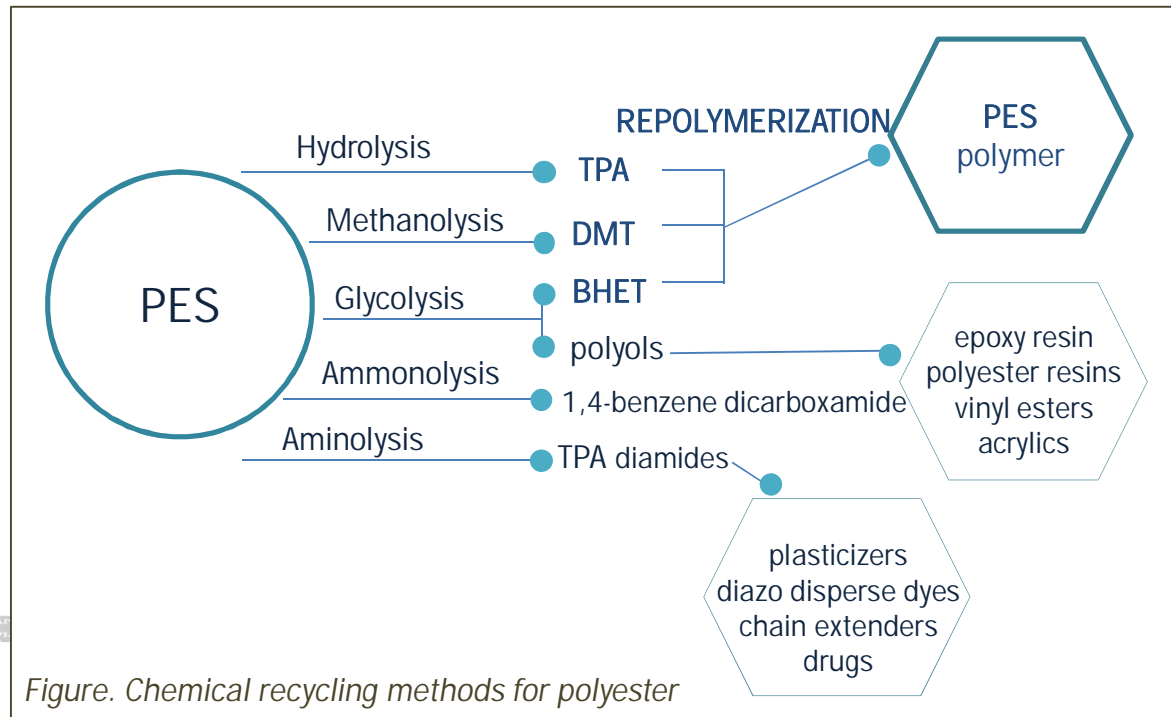
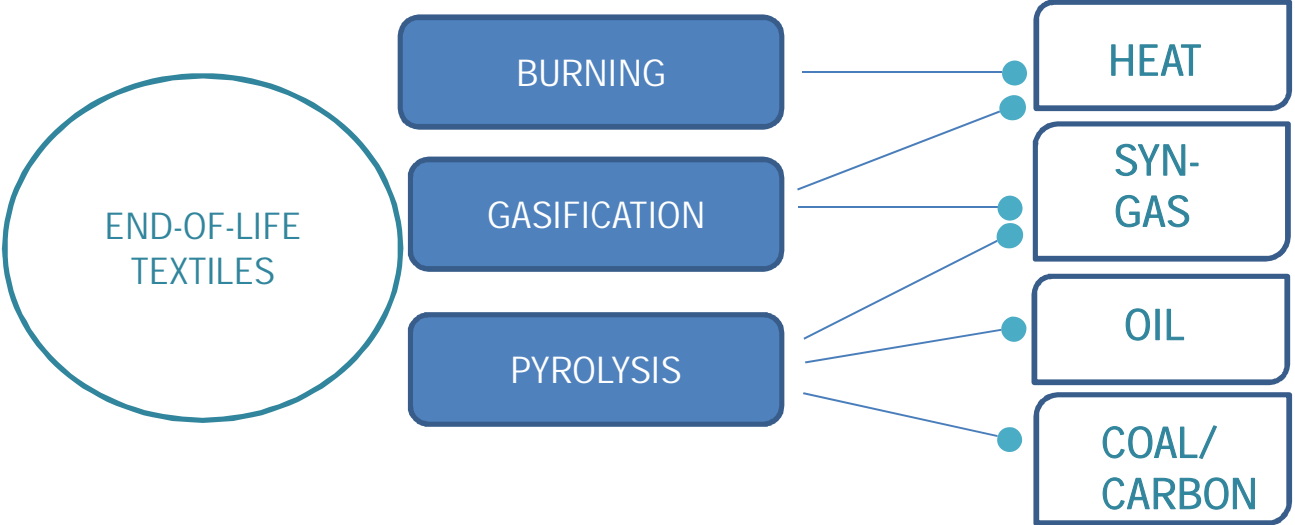


Figure. Chemical recycling methods for polyester

End-of-life options



Summary



End-of-life textiles are suitable raw material for different existing processes



Sorting is often essential for value added applications



Environmental impacts will remain unchanged if reuse and use of recycled material does not replace the use of virgin material in textile production



The viability of the recycling process depends on a number of often interrelated factors such as the purity of the waste stream, the cost of the process investment and the value of the end product





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