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ECOSIS

An Eco-Friendly Process of Infinite Textile Creation



CONSUMPTION OF POLYESTER FIBER IS INCREASING

World population is exploding

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- Per capita consumption of Fabric is increasing, especially in population dense – third world countries
- > Natural Fibers have limitation of growth
 - > Competing demand for arable land
 - > Agriculture
 - Bio-fuel raw material
 - > Liquor raw material
 - Bio-degradable plastic raw material
 - > COTTON
 - Land needed for Infrastructure development
 - Land used for re-forestation requirement to minimize GHGs
- Amongst Synthetic fiber Polyester is most cost effective and versatile

Demand for polyester fiber is increasing very fast



POLYESTER – The Preferred Fiber

With the increase in fast fashion trends and the constant want to update one's wardrobe with the latest style and design, polyester is the most preferred fiber and will continue to dominate its role in textiles in the future.

Its unique properties and diverse applications along with ease of processing make it the ideal choice for garments and home textiles.



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CONSUMPTION OF TEXTILES (KG/PERSON)



FIBER CONSUMPTION (MILLION TONS) 2022

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WASTE DISPOSABLE METHODS





LIFE CYCLE ASSESSMENT

Life cycle assessment (LCA) is a scientific method for making comprehensive, quantified evaluations of the environmental benefits and tradeoffs for the life cycle of a product system throughout its life.

- LCAs begin with raw material extraction and continue through disposition at the end of their useful life. Life cycle analysis (LCA) generally conducted following internationally accepted standards for LCI (Lifecycle inventory) and LCA methodology as outlined in the ISO 14040 and 14,044 standard documents.
- > As indicated in life cycle assessment studies, increases in recycling lower the energy required to manufacture products.
- The future for PET will reduce energy demands further with the largest breakthroughs in recycling technologies and bio-sourced resins trending toward zero energy and carbon negative solutions.

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LIFE CYCLE ASSESSMENT

- > As shown in LCA, there are different recycling methods/routes like mechanical recycling, chemical recycling, recycling by Bio-degradation or by incineration.
- PET is a versatile material with ability to be remade from its polymer state through mechanical recycling and even back to its original monomer through advanced recycling method..
- Advanced recycling method includes chemical recycling, a process by which a polymer is reduced at the chemical level to its original or intermediate monomer form so that it can eventually be re-polymerized and remade into the same or new plastic materials that go on to be new products.
- Another reason for choosing Chemical recycling processes is that it permits the treatment of plastic waste even if highly contaminated. The results are recyclates that have the same quality as virgin material.
- Main Feed stock for preparation of virgin Polyethylene Terephthalate is Pure Terephthalic Acid (PTA) OR Di- methyl Terephthalate (DMT) and Mono ethylene glycol besides catalyst , additive and co-polymers.





MOLECULAR STRUCTURE OF POLYESTER

- > Chemically the structure of the polyethylene terephthalate is same for application in
 - Textiles
 - Packaging

POLYETHYLENE TEREPHTHALATE REACTION



- > Their process of recycling would also by same
 - Mechanical Recycling
 - Chemical Recycling

MECHNICAL RECYCLING OF POLYESTER

- Mechanical recycling involves physically reshaping PET into new products through a thermal process that involves
 - ➤ grinding,
 - heating, and
 - > reforming.
- However, this process often leads to thermo-oxidative and thermo-mechanical degradation, resulting in lower molecular weights, higher degrees of branching, impurities from previous use, and discoloration.
- > These factors limit the potential for high-value applications of recycled materials.
- Most importantly it limits the number of cycles the polymer can be subjected to recycling process. De-facto, after maximum 2 cycles, polymer no longer can be recycled and has be discarded.

CHEMICAL RECYCLING OF POLYESTER

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- > On the other hand, Advanced Recycling includes Chemical Recycling.
- > We intentionally depolymerize PET into monomers or oligomers using
 - > solvents,
 - ≻ heat,
 - > catalysts, or
 - > other selective stimuli.
- The resulting product has higher purity, enabling use in high-value applications and supporting a circular economy.
- Solvent-based depolymerization methods leverage a reactive solvent to break down PET into a wide array of products.
- > Depolymerization methods include hydrolysis, alcoholysis, glycolysis, aminolysis, and ammonolysis.
- The recycling of the textile waste is a very complicated process due to mixture of different polymers as well as the different types of dyes.



METHODS OF CHEMICAL RECYCLING





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ENVIRONMENTAL BENEFIT OF CHEMICAL RECYCLING



CRADLE TO PTA CRADLE TO EG PET PRODUCTION