Sustainable Materials from Textile Industry revalorization focused on chemical recycling

Call: Seventh call for bilateral projects in international technological cooperation with third countries (UNILATERAL projects).

CDTI website:

http://www.cdti.es/index.asp?MP=101&MS=842&MN=2&TR=C&IDR=2183&r=1440*900

Deadline: 17th of September

1. Summary:

The concept of Circular Economy is based on the reuse, repair, and recycling in a closed loop process to avoid the traditional economic model which is based on the consumption and disposal of the used products. The main goals of the Circular Economy are closing the loop by achieving highly valued new products and materials and reducing waste to a minimum. Moving towards a more circular economy will deliver opportunities such as reducing pressures on the environment, enhancing the security of supplying raw materials, increasing the competitiveness, innovation, business growth and new jobs. Plastics have proven benefits during their use phase, but in their end-of-life, it is necessary to apply a recycling process to contribute to the Circular Economy approach.

Moreover, there is an increasing regulatory pressure regarding recycling targets and recyclability and strong commitments towards increasing the use of recycled materials. Solving these challenges requires innovation and joint efforts globally across the value chain.

Since mechanical recycling is limited, e.g. due to high sorting requirements and decreasing material quality in each cycle, it has taken up this challenge to develop innovative technologies that promote chemical recycling of polyester textiles. **Chemical recycling** allows to recycle plastics that do not have recycling solutions or missing capacities today and is therefore complementary to mechanical recycling.

Recycling Polyester Fabric scrap is essential for the environment. Efforts should be maintained to ensure that natural resources are returned to nature in a sustainable manner. In Egypt the sustainable recycling of synthetic fiber is not established. Currently the methodologies used are waste incineration, landfill and uses in other issues.

The main objective of this proposal will be focused on the development of different processes for industrial chemical recycling of textiles focused on polyester to obtain between others terephthalic acid to new polyester resins or well oligomers as a precursors of alkyd resins (other applications will be evaluated). The newborn

monomers will be applied in different applications for their validation (such as non-food packaging, fibres, paints, coatings, etc..) and will be evaluated to apply the mandatory regulations (REACH).

The new developed technology includes research and synthesis of new catalysts and conditions that enhanced recycling processes as well as the optimization of several chemical recycling processes to create newborn valuable products.

Moreover, the chemical recycling process will be scaled and tested in a new construction pilot plant using a novel catalyst which overcome higher productivity for the desired depolymerization processes (patentable and intellectual property). These catalysts will be recovered and reuse for an economically and environmental circular economy.

In summary, **textile companies are among the different industrial sectors where this technology could be applied with good results to transform polyester textile wastes in a desirable monomer to give a new life for the used materials.**

2. Expected Impact:

Textile recycling of polyester fabric scrap offers the following benefits:

- Reduction of the landfill volumes.
- Reduction of the energy and water consumption at industrial level.
- Pollution avoidance.
- Creating an added value to the current zero value polyester fabric scrap.
- Saving natural resources.
- Lowering the greenhouse gas emissions and the usage of chemicals.
- Encouragement of the solid waste management.

3. Consortium:

Egyptian consortium:

- Plastic Technology Center-Industry Council for Technology and Innovation-Ministry of Trade and Industry
- Egyptian company (role: collection, washing and grinding of clothes)

Spanish Consortium:

- AIMPLAS- https://www.aimplas.es/ (to be subcontracted by the Spanish Company).
- Spanish Company/ies – To be added

4. Role of the Spanish company:

The role of the Spanish company will be focused on the production and/or valorization of the newborn monomers (BHET, TA) obtained from the chemical recycling of polyester textiles. The obtained monomers will be transformed in new products for the consumers to close the loop.

If require, the company will also validate the final products obtained from the recycled raw materials and evaluate their properties for the final applications.

5. Description of work:

In this project, there are 5 tentative work packages to be achieved in 24 months.

The final work plan and project approach will be discussed with the Spanish company/ies and addressed according to its contributions and capacities.

WP1: Development of chemical recycling technologies at laboratory scale.

- Task 1.1: Development of different technologies for chemical recycling (Glycolisis, solvolysis…).
- Task 1.2: Optimization of the reaction conditions at laboratory scale.
- Task 1.3: Selection of the best technology.

WP2: Development of catalyst for the chemical recycling

- Task 2.1: Testing of commercial catalyst
- Task 2.2: Development of novel catalyst for chemical recycling
- Task 2.3: Recovering of the catalyst

WP3: Valorization of the recycled monomers.

- Task 3.1: Characterization of the recycled products
- Task 3.2: Formulation of newborn products from recycled monomers

WP4: Safety and regulations for recycled materials

WP5: Validation of technologies at pilot scale.

- Task 5.1: design and construction of pilot plant
- Task 5.2: Test and validation of pilot plant

6. Budget for the Action:

The budget for the Spanish entity will be defined once the description of work adjusted and agreed with the Spanish company. The Spanish company budget will not be less than 175.000 € (as set by CDTI in the call bases), and will cover personnel costs, materials, overheads, and the cost of subcontracting AIMPLAS.

7. Contact details.

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