The Solution

In response to the continuous increase of the amount of improper and degradable plastics, which remain mixed with the waste polyethylene (PE) films that reach the treatment sites and decrease the quality of the recycled material, a special Film Sorting Machine (FSM), for an improved recycling of these post-consumer wastes, has been developed and built at the FILMSORT Project.

Project Overview

The involved participants merged their knowledge on applied research related to plastic wastes recycling and environmental evaluation (GAIKER-IK4), ability for the manufacture of automatic identification and sorting equipment (RTT Steinert) and experience on polyolefin recycling industry and markets (CORDOPLAS).

As result of this cooperation the physical outputs to be achieved by the FILMSORT Project were:

- A new identification and sorting equipment for waste plastic films: the Film-Sorting Machine (FSM).
- A study of the potential improvement in the grade of the recycled PE pellets from post-consumer waste films based on the expected introduction of the Film-Sorting Machine (FSM) in the current recycling scheme for these materials.
- An environmental assessment of the innovative solution for waste plastic films recycling by means of a LCA study.
Partners

GAIKER-IK4, Technological Centre, located in the Technological Park of Bizkaia, is devoted to the up-take of own knowledge and to the development of new technologies that are later transferred to customers coming from sectors such as the Pharmaceutical Industry, Chemical Industry, Human and Animal Health, Engineering and Consultancy Firms, Public Administrations, Automotive Industries, Construction, Packing and Packaging, and Home Appliances, amongst others.

From 1985, the Centre has carried out close to 1,500 R&D Projects related to its Knowledge Areas: Biotechnology, Environment and Recycling and, Plastics and Composites. Besides its activity in R&D, GAIKER-IK4 offers to its customers Advanced Technological Services, Analysis and Tests and Technological Dissemination Services.

GAIKER-IK4, which at present counts on more than 100 employees, was awarded in 2008 by the European Foundation for Quality Management (EFQM) with the “Prize Winner” for the best European organisation in “Management for Process and Facts”. GAIKER-IK4 also has the ISO 9001 and ISO 14001 certifications.

RTT was founded in 1990 after the German reunification and is located in Zittau near the Polish border. There are 35 employees in the Headquarter in Zittau. RTT as an SME is an equipment manufacturing company and provides sorting solutions to the waste and recycling industries. RTT also provides the European automotive industry with customised solutions in the field of special machinery and equipments. In 1995, RTT introduced the first UniSort®, a Sorting Module for plastic bottles and other recyclable materials. From the very beginning, RTT has invested substantial resources in developing customer-oriented sorting technologies.

Cutting-Edge Technologies based on a highly selective NIR UniSort® Sensorsystem enabled RTT to develop original and powerful analytic measurement tools to detect recyclable materials in automatic and online mode.

CORDOPLAS collects plastics waste materials, mainly HDPE and LDPE both industrial and post-consumer origins, and produces recycled plastic pellets. The production process is a complex sequence of operations that includes: selection and sorting, granulation, washing and cleaning, extrusion, palletising, packaging and storage. Applications for LDPE are irrigation pipes and films, for HDPE blow moulding, injection moulding and corrugated pipes and for PP injection moulding. The products are verified according to customer specifications.

The company is certified as authorised ECOEMBES recycler for post-consumer light packaging waste, hazardous waste manager, ISO 9001:2008 and ISO 14001:2004 and the silver eco-label from the Municipality of Córdoba (Spain).
Activities - Workpackages

- WP1. Project Management: coordination of partners to fulfil objectives and make adequate use of the resources and communication with the EC.

- WP2. Identification and Separation Modules. Adjustment and Optimization: development of the specific modules for the identification and separation of waste plastic films.

- WP3. Construction and Validation of the Film Sorting Machine: building of the Film Sorting Machine (FSM) integrating the developed identification and separation modules once tested and adjusted.

- WP4. Classification Tests: validation of the Film Sorting Machine (FSM) by testing the waste plastic films and analysing the separation results.

- WP5. Development of New Products Using Recycled Plastic Film: characterisation of recycled plastic films (intermediate products) and definition of application (final products) if the Film-Sorting Machine (FSM) is introduced in the current recycling scheme for post-consumer waste films.

- WP6. Exploitation and Business Plan and LCA: development of the exploitation and business plans and completion of the Life Cycle Analysis (LCA) to measure the environmental impacts and improvements of the recycling scheme if the FILMSORT solution is implemented and if final products are manufactured including high grade recycled plastic films.

- WP7. Dissemination Activities: fulfilment of common dissemination activities on request of the EASME and project specific ones defined by the consortium.

Results

The results of the FILMSORT Project are:

- The main outcome is a new developed equipment for plastic recyclers, the Film Sorting Machine (FSM) to be commercialised as “UniSort Film”, including an identification system based on near infrared hyperspectral imaging (NIR-HSI) for the recognition and classification of different film types and the suitable devices for sorting them suppressing turbulent air eddies in order to enrich the PE film fraction and separate the other materials.

- Upstream, the main outcomes are the new designed, developed and tested specific parts, the sensors and actuators which mounted as modules on the Film Sorting Machine (FSM), for dealing with the specific features of the waste plastic films.

- Downstream, the main outcomes is the description of the procedure to manufacture improved grade recycled PE pellets from post-consumer waste films based on the introduction of the Film-Sorting Machine (FSM) in the current recycling scheme for plastic waste films.

- Environmental assessment, by using LCA, of the waste plastic films recycling including sensor based identification and sorting operations, considering both the achievable results when implementing the developed Film-Sorting Machine (FSM) and the potential to manufacture final plastic products which include high grade recycled plastic films.
Before Filmsort

Waste classified film 100%

Visual inspection

Film 92%

1

Shredding

2

Blades Sharpening

3

Washing and rinsing

Clean film 86%

LDPE Pellets 84% (Purity: 95.87%)

Filtering and extrusion

0.156 kWh/kg (20%)
Water: 0.650 m³/t
Dense material and dirtiness: 6%
Waste water: 0.650 m³

0.429 kWh/kg (55%)
Filters: 1/60 kg
Non-melted material 2%

After Filmsort

Waste classified films 100%

Visual inspection

Film 92%

1

Shredding

2

Blades Sharpening

3

Automatic identification and sorting

Film 82.8% (99.97% purity)

Improper & degradable polymers 9.2%

4

Washing and rinsing

Clean film 80.8%

Dense material and dirtiness: 2%
Waste water: 0.585 m³

5

Filtering and extrusion

LDPE Pellets 79.8% (Purity: 99.97%)

Non-melted material 1%
The Market

The direct market for the FILMSORT technology are the over 200 - 250 plants, mainly SME, that are estimated to be behind the treatment and recycling of 1,600,000 - 2,000,000 tonnes (according to plastics facts in Europe in year 2011) of post-consumer PE waste films and the waste light packaging sorting facilities that perform the first classification of films. The market for the recycled PE from plastic film waste continues being the producers of irrigation pipes and plastic bags.

The European Added value

LCA methodology has been used to assess the environmental profile after including the FILMSORT innovation in the recycling scheme for the post-consumer plastic and PE films waste and the manufacture of plastics products including recycled PE films. The results showed that after its successful implementation it could lead to environmental benefits such as cutting the CO₂ emissions by 10% and lowering energy consumption by 8%. Additional savings were estimated in 10% for washing and rinsing water and in 40% for the non renewable resources used in the manufacture of virgin PE that could be replaced in the final applications by recycled PE from plastic film waste.

The FILMSORT technology will be a tool supporting the achievement of recycling targets at Directive 2004/12/EC on packaging and packaging waste and/or the proper management of waste and the optimum usage of resources at Directive 2008/98/EC on waste.
ECO-Innovation Programme

The programme: CIP Eco-innovation First Application and Market Replication Projects.

Launched in 2008, the Eco-innovation initiative is part of the EU’s Entrepreneurship and Innovation Programme (EIP), set up to support innovation among SMEs and to improve their competitiveness. It is included in the EIP’s annual work programmes.

The EIP is part of the wider Competitiveness and Innovation Framework Programme (CIP) aimed at encouraging the competitiveness of European companies, in particular SMEs.

The Eco-innovation initiative is one of the measures designed to implement the EU’s Eco-innovation Action Plan (EcoAP).

References


