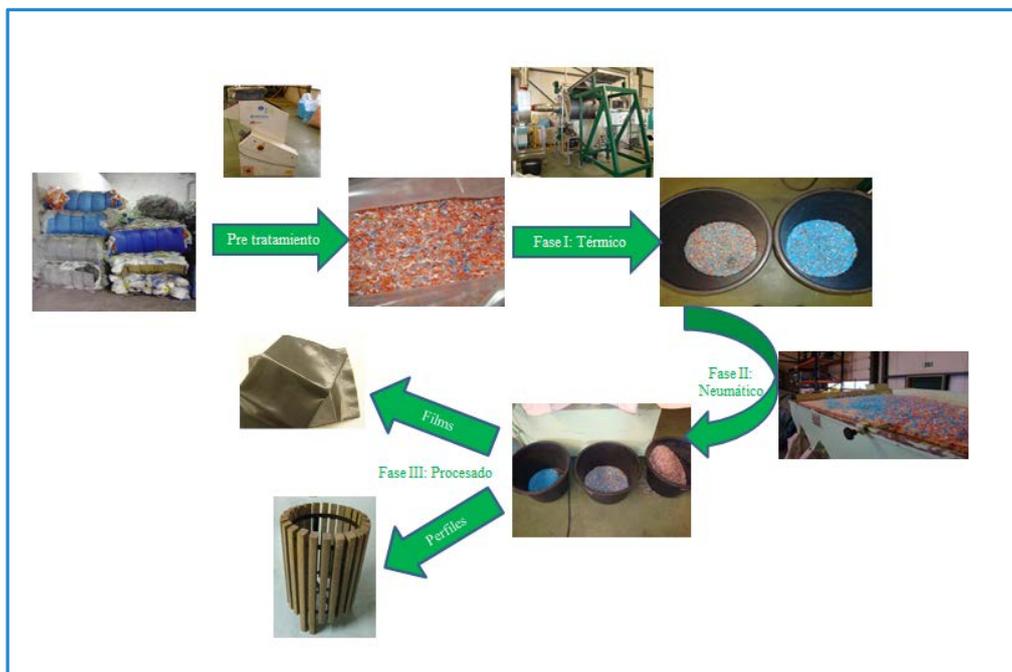




# DISEÑO Y DESARROLLO DE UNA PLANTA PILOTO DEMOSTRATIVA PARA EL RECICLADO POR SEPARACIÓN DE MEZCLAS POLIOLEFÍNICAS POST-CONSUMO

(LIFE10 ENV/ES/000460)

<http://www.rec-polyolefin.eu/>



## Background and objectives

One of the fundamental problems in the recycling of polyolefin type post-consumer plastic film is that the items of wastes separated by commonwealths, municipalities and companies engaged in waste management are always a mixture of three components (low density polyethylene or LDPE, high density polyethylene or HDPE and polypropylene or PP).



United States and the European Union consume the 80% of the global production of plastic bags. Specifically, Spain is the third European country to use plastic bags for single use, each person receives annually an average of 238 of these bags, which take 400 years to decompose and of which only 10% is recycled. In Western Europe the total consumption of polyolefins is 47% (11.2 million tonnes) compared to 24.1 million tons of plastic consumed annually. Current projections show an annual increase until 2013 of a polyolefins' consumption of 2.45%.

Most part of this material is discharged after use and this raises important environmental problems particularly considering that these materials are not biodegradable.

Because of this, L'Urederra found a gap in the recycling of polyolefinic materials mixes and set out to design and develop a method based on a heat treatment which allows separating the LDPE from other polyolefins.

The working principle proposed in this project for the separation of LDPE, HDPE and PP is based therefore on that if the fragments of the mixed film for these three types of are subjected, and of dimensions between 25-100 cm<sup>2</sup> just as they leave the system, to heat and mixing with the objective to ensure good heat transfer process, there will be a range of temperatures rather wide, in the vicinity of 100 ° C, in which the fragments of film of LDPE shrink passing crumpled to form plastic beads, while the fragments of HDPE and PP remain unchanged and may be separated by conventional techniques into two streams, one of LDPE and HDPE + PP another. This post-consumer polyolefins mixes separation method was validated by Lurederra during the project "Primary Recycling of mixed polyolefin films for high added value applications in the blow molding industry (RECFINMIX)" file number COOP-CT-2006- 032 766.



*Behaviour of polyolefin with temperature*

Once the process validated at laboratory scale, we proceeded to the development of the pilot recycling plant, through the project LIFE10 ENV/ES/000460. The main objective of the project REC-POLYOLEFIN is the design and development of a demonstration pilot plant with a treatment capacity of 1000kg/h of material. The purpose of the demonstration plant is that from a mixture of polyolefins (LDPE, HDPE and PP) is to sort as much material as possible into two fractions. One of these fractions would be almost pure LDPE (> 95.5%) and, thus, processable by extrusion blow moulding, and other interesting fraction of HDPE and PP (<20% LDPE), which would continue to be applied in materials with lower technical requirements such as extrusion profiles or bars.

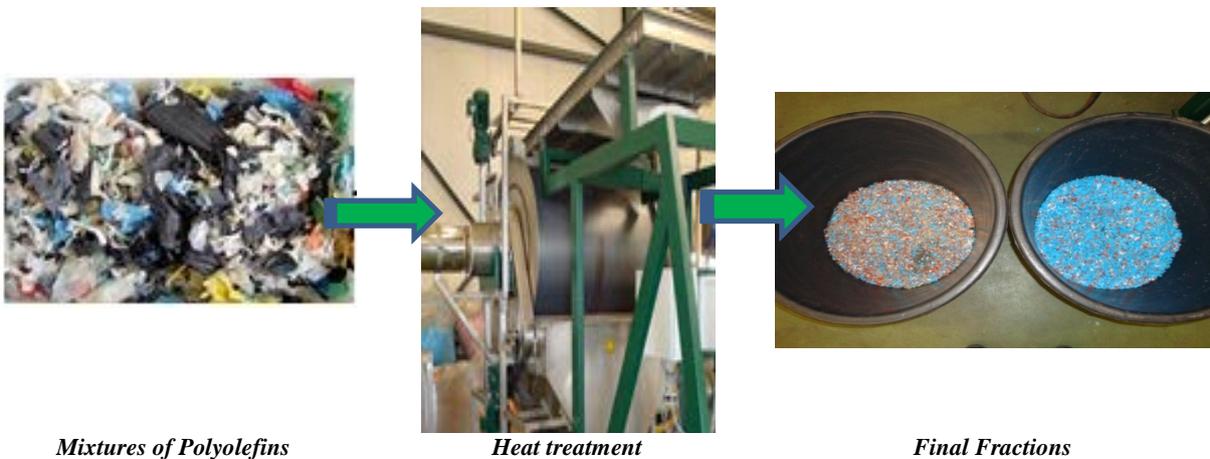
## Obtained Results

The demonstration pilot for the separation of polyolefin mixes consists of 4 steps. Two of the four steps were developed during the project and the other two phases correspond to a pre-treatment procedure of the starting material and final processing of the product.

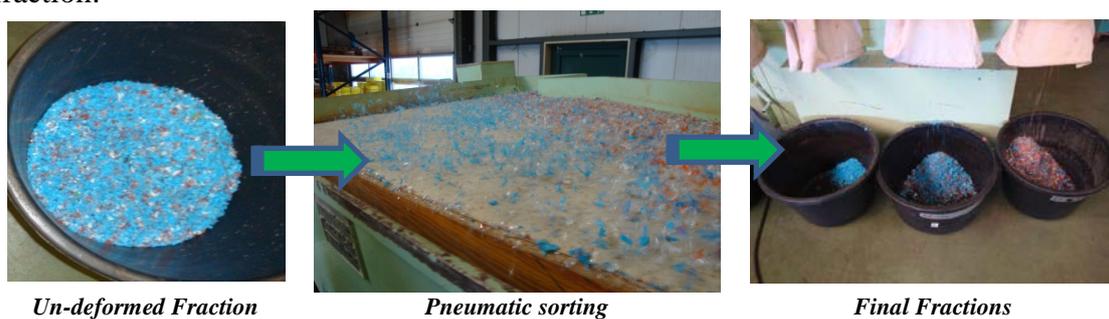
The two phases of recycled polyolefin developed in the project are explained below:

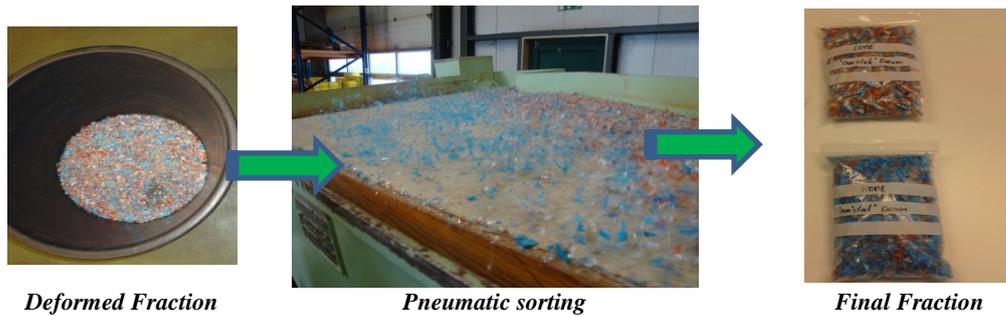
- **Phase I:** Phase of heat treatment developed by partner MOS. The pre-treated samples are introduced into a drum to be treated with temperature, obtaining two different fractions:

- Fraction of deformed polyolefins (low-PP)
- Fraction of un-deformed polyolefins (high in PP)

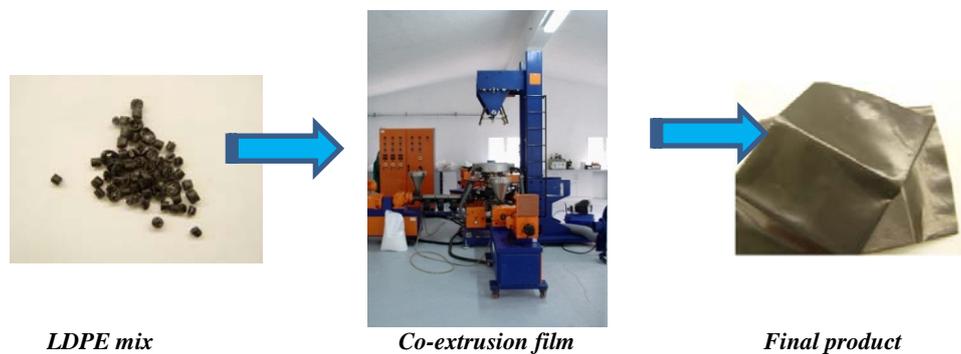
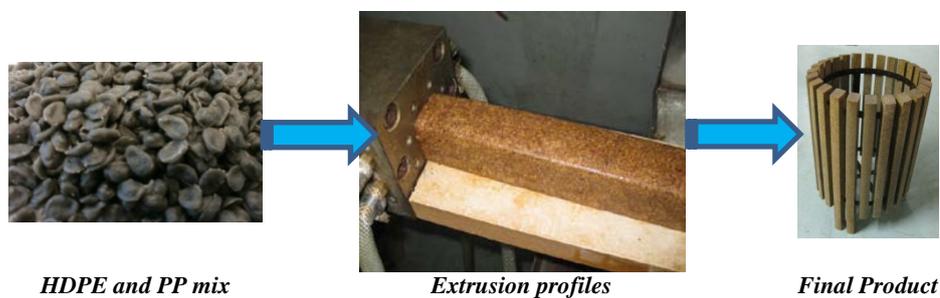


- **Phase II:** Pneumatic separation phase developed by PHB. The two fractions obtained from Phase I (deformed and undeformed) are treated in the pneumatic separation system obtaining three different fractions of the undeformed fraction and two of the deformed fraction:





Once the different fractions of polyolefins are obtained, we proceeded to the final processing of both film and profiles. The film obtained from the purest fractions with highest percentage of LDPE and oriented to be applied such as bags and the profiles obtained from mixes of HDPE and PP for applications in street furniture, for example. The diagrams below show some of the schemes:



### **Benefits and impact of the project**

The separation of these three types of polyolefins, in film form, using commonly used technologies has many difficulties. The usual methods of separation of mixtures of plastics are based on density difference, but in this case is not applicable because of the similarity of their values (LDPE = .91-.94, .95-.97 = HDPE, PP = 0.90 -0.91). Furthermore, the spectroscopy based methods are also not applicable for this procedure due to its difficulty of films handling, however, this technique is applied in bottle recycling.

Therefore, currently the only polyolefins that are used in the development of recycled film are from waste of the plastics industry, and in some particular case, the material could also be obtained from the packaging industry, which also can be used in extrusion blow moulding.

