RESEARCH LINE 9B	
COMPANY	**Ecoembes**
PhD THESIS SUPERVISOR (UPM)	Prof. Dr. Marina Patricia Arrieta Dillon *Industrial Engineering School* *Chemical, Industrial and Environment Engineering Department*
PhD THESIS CO-SUPERVISOR (COMPANY)	Dr. Jorge García Barrasa *Ecoembes*
DESCRIPTION OF THE PhD THESIS PROJECT	The world plastics production has reach over 360 million tonnes in recent years. However, both the high consumption of non-renewable petrochemical raw materials for its production, as well as the accumulation of large amounts of plastic waste in landfills, have generated a growing interest in seeking solutions to achieve responsible production and consumption (SDG 12). Currently more than 25% of post-consumer plastics are deposited in landfills, representing a big source of pollution that affects life in terrestrial ecosystems (SDG 15) and underwater life (SDG 14). Nowadays, the food packaging field is one of the most important application sectors of plastics. It has been observed that numerous polyolefin residues, polyethylene (PE) and polypropylene (PP), reach recycling plants. However, the introduction of such recycled plastic in the food packaging sector still remains a challenge and the European strategy for 2030 encourage increasing the recyclability of single use plastics as well as the incorporation of recycled plastic in new formulations (i.e., specific targets include incorporating 30% of recycled plastics in all plastic beverage bottles from 2030). Nowadays, although the recycling rate of PE (rPE) is high, it is mainly used in non-food applications. In fact, its recycling in food packaging is limited probably due to the additives such as fillers (i.e.: TiO_2, $CaCO_3$, silicates or carbon black) used to improve the overall performance. These additives appear in variable and unknown contents in recycled materials, and they can promote polymer degradation during recycling as well as the migration of packaging components to the foodstuff. This degradation of the polymer is another fundamental limitation for the use of recycled plastics. Therefore, it is necessary the development of new approaches to limit this degradation and the migration of degradation products and fillers, which will allow obtaining recycled materials with better performance and able to extend the applications of recycled plastics to the food packaging field. In this PhD Thesis the polymer degradation during recycling and the effect of the presence of additives and/or fillers on the properties of recycled non-PET plastics (mainly polyolefins) will be studied, with a focus on reducing migration issues. The viability of different approaches to improve the overall performance of recycled polyolefins, such as the incorporation of novel functional barriers or development of composites to reduce the migration, will be explored. As there are not safe methods to clean the recycled plastic, approved by the European Food Safety Authority (EFSA), able to allow the recycled materials to be in direct contact with food, novel functional barriers which are not so widely explored for polyolefins, but that can lead to good results will be studied. Another approach to be considered is the development of nanocomposites of recycled polyolefins loaded with low amounts of both, inorganic and organic fillers. In order to promote inclusive and sustainable industrialization process (SDG 9), the recycled polyolefin will be either doped with the inorganic fillers usually present in recycled polyolefins (i.e.: TiO_2, $CaCO_3$, silicates or carbon black) and/or organic fillers obtained from wastes coming from the agri-food industry.

	Then, the multilayer recycled-based materials will be characterized concerning the intended application in the food packaging field. Especial focus will be paid on the migration phenomenon of the different fillers and/or short polymeric chains from the packaging material to the foodstuff. The main objective is to get information regarding the possibility to extend the use of mechanically recycled non-PET plastics into food packaging applications. The results can help meet European Union policies on plastic recycling and circular economy, as well as mitigate the negative effect that non-recycled plastics produce on climate change (SDG 13). It is expected that high performance non-PET recycled plastics will be obtained processed by means of the already available processing technology at industrial level. The thermal, structural, mechanical, optical, barrier and migration properties will be tested. It is expected that the present research will open a new perspective for the industrial application of non-PET recycled plastics as sustainable materials for food packaging applications.
TRAINING ACTIVITIES	- Specific formation in processing and characterization of plastics by experienced researchers from ECOEMBES and UPM. - PhD courses - International PhD program (International research mobility)
SECONDMENT(S)	International research stays in other laboratories and short visits with our collaboration groups (i.e.: Civil and Environmental Engineering Department, Materials Engineering Centre, University of Perugia, (Terni, Italy); Food Packaging Laboratory (LABEN, Universidad de Santiago de Chile, Chile).
REQUIREMENTS FOR CANDIDATES	**Degree** (MSc, in Polymer Science, Materials Science, Chemical Engineering, Food Technology, Chemistry or equivalent) **Skills**: strong teamworking skills; thermoplastic processing, knowledge of polymer characterization techniques and good command of written English. **Background**: in Polymer Science and Engineering.