

## REPESCAPLAS: A STEP TOWARDS THE RECOVERY OF MARINE LITTER

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The term 'marine litter' is becoming increasingly important in the news and in specialized press. It represents a global problem that affects the whole planet and is caused in most cases by inadequate waste management. We must bear in mind that, although 80% of marine litter is considered to be generated on land, it reaches seas and oceans, thus affecting the environment in different ways. It is a huge problem for the environment, the economy and society. Marine litter affects the environment's biodiversity, but it also has an impact on the industry, very negatively for certain sources of income in some areas such as tourism, fishing and pisciculture. Furthermore, we should not forget that a very important loss of wastes takes place. If these wastes would have been originally treated, they would be material or energy resources.

This problem is increasing. It is estimated that, every year, ten million tons of rubbish end up in the seas, so it is crucial to stop this trend and remedy the current contamination. In this context, the European Commission expressed its worry too, including it last January in the Strategy for Plastics in a Circular Economy. The strategy indicates that 84% of marine litter products are plastics and 50% of the total are single-use plastic products.

The presence of plastic consumer goods is, therefore, a reality and is aligned with the data collected in a recent Eurobarometer survey (2017), which showed 87% of citizens are worried about the effect of everyday plastic products on the environment and 74% of them worry about their effects on health.

The solution must be performed mainly in the origin, thus avoiding the abandonment and arrival in seas by carrying out effective collections of wastes where they are produced and thus allowing their recovery in order to obtain new materials or energy. However, the problem is still present in seas and, therefore, it is necessary to extract litter from the aquatic environment and manage it properly. Within this context, the project [REPESCAPLAS](#), 'Material recovery of plastic wastes collected from the sea: characterisation, applications and product development', is born. This project is being developed in Spain in conjunction with the Ministry for Ecological Transition's Fundación Biodiversidad through the program Pleamar, co-founded by the Spanish Federation of Municipalities and Provinces (FEMP). [AIMPLAS](#), the Plastics Technology Centre, is the beneficiary, with the participation of Fundación Global Nature, Asociación Vertidos Cero, the University of Vigo and the Fishermen Association of Gandia.

The project will be developed in 2018 and is aimed to:

1. Extract marine litter from the sea.
2. Train and raise awareness among the fishermen of the problem that marine litter represents and their essential role in the collection tasks.
3. Analyse the products and materials collected from the point of view of quantity and nature and their influence on fishing gear.
4. Test the toxicity of the products collected by analysing their effect on biological marine indicators.
5. Demonstrate that marine litter can be recycled by obtaining products from it.
6. Make these points known to the general public in order to raise awareness.
7. Communicate to the plastics sector the possibilities that marine litter can represent, so it can join the recovery chain and wastes are sustainable over time.

The project is in progress and different marine litter collection actions have already been performed both in the Mediterranean Sea (Fishermen Association of Gandia, Valencia) and in the Atlantic Ocean (Vigo).

Different fishing gear, regularly used in these areas, have been analysed, such as trawling and trammel net fishing. Up to now, different results related to the objectives mentioned above have been obtained.

More than 800kg of marine litter have been already collected, corresponding to 4,070 objects, of which 78% are plastics, 9% metals, 7% others (including objects like clothes, fabrics, shoes, tires, etc.) and 6% paper, cardboard, wood and glass, among others.

The most abundant products have been (see Chart 1): industrial packages, bottles, food packaging and plastic bags, fishing items and threads and ropes, among others. As we can see, although there are differences between both areas, there are a lot of products in common and even some of them have the same position in the ranking. This is because, as we mentioned before, a large part of the marine litter come from the land area, so it is usual to find items associated with daily human consumption.

Marín (Galicia)	Item	Percentage on item	Gandía (Valencia)	Item	Percentage on item
Industrial packaging	252,26	27,69	Bags	978,91	30,99
Plastic bottles	210,84	23,14	Food packaging	832,07	26,34
Bags	124,25	13,64	Industrial packaging	485,69	15,38
Fishing objects	82,83	9,09	Plastic bottles	297,44	9,42
Food packaging	67,77	7,44	Fishing lines	199,55	6,32
Nets	64,01	7,02	Unidentifiable items	180,72	5,72
Ropes	60,24	6,61	Ropes	101,66	3,22
Gloves	22,59	2,48	Fishing nets	52,71	1,67
Fishing line	22,59	2,48	Agriculture items	26,36	0,83
Unidentifiable items	3,77	0,41	Gloves	3,77	0,12
<b>TOTAL</b>	<b>911,14</b>	<b>100</b>	<b>TOTAL</b>	<b>3.158,86</b>	<b>100</b>

Chart 1: Most abundant products in the areas of Galicia and the Valencian community.

From all the wastes, the plastic fraction was selected, and its nature was analysed. It was found that the items were made mostly of polyethylene (PE) and polyethylene terephthalate (PET), materials widely used in plastic packages, which coincided with the type of products found.



Figure 1. Marine litter (bags and food packages)



Figure 2. Marine litter (bottles and fishing items)

Moreover, as mentioned before, there are other types of wastes found corresponding to material characteristics different from plastics.



Figure 3. Marine litter (glass bottles and metal cans)

These fractions were treated at AIMPLAS' recycling pilot plant for their grinding, washing and drying. Note that these materials are quite degraded in most cases, so the treatment is difficult, at least with the current recycling technologies. Then, sheets were obtained from the recycled material by plate temperature processing in order to analyse its processability.



Figure 4. AIMPLAS' recycling pilot plant.



Figure 5. Grinded PET sample and thermoformed sheet.

The sheets obtained allow us to study the recycling opportunities and show that the material is processable to obtain new products. At present, following the processability assessment, a usual process in the plastics transformation will be performed, injection moulding, to obtain parts demonstrating the value of the marine litter collected.

At the University of Vigo, eco-toxicity tests will be performed. They will provide a quantitative estimation of the ecological risk derived from the laboratory studies with the 250- $\mu\text{m}$  grinded material (size associated with microplastics) generated from the litter collected.

The bioassays follow a standard methodology. A test has been performed in the first species (sea urchin or *Paracentrotus lividus*) with the three most abundant items, thus obtaining good results; in other words, there is no toxicologic contamination. These tests will be repeated in coming months, thus increasing the number and types of samples to be treated.

The project REPESCAPLAS is demonstrating the loss of resources that marine litter represents, whatever the origin is; therefore, it is necessary to work preventively for wastes to be initially recycled so they do not reach the sea.

For that purpose, it is important to focus on public awareness of the existing real problem to go towards the reduction of the abandonment of materials, thus helping to preserve the environment.

Another way of disseminating the project is by means of fishermen associations, since they are a key part in the management of these wastes. For that purpose, different events and exchanges of knowledge are taking place for the professionals of the sector in order to involve more ports and collect a larger quantity of marine litter.

Meanwhile, and due to the big mass of litter present in the sea, it is necessary to keep extracting them in order to give them a second life.