Project no: 218609

Project acronym: EURECOMP

Project full name: Recycling Thermoset Composites of the SST

Publishable summary

- **Summary description of project context and objectives**

The goal of the project is to set up a new route to recycle fibre-reinforced composites. In the surface transport industry, no really satisfactory way has been found so far for composite production waste and end-of-life products, in particular for thermoset composites due to their cross-linked three-dimensional chemical nature. The European legislation now implies to recycle this waste instead of landfilling it. Incineration is restricted due to poor energy efficiency and polluting emissions, and the existing recycling methods show limitations:

- mechanical recycling (insufficient separation of the components)
- energy recovery (no recovery of reusable raw materials)
- feedstock recycling: breaks down the polymers into low molecular weight species using heat (gasification and pyrolysis) and chemicals (solvolysis, but so far only applied to thermoplastics).

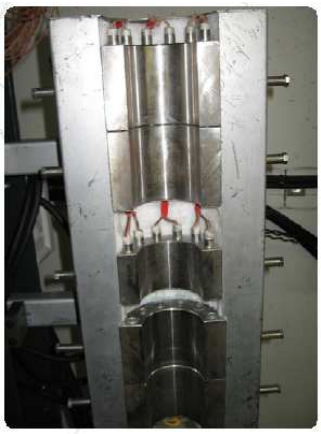
The project aims to develop the physico-chemical separation process called solvolysis in order to convert the organic phase of thermoset composites into small molecules that can be reused as organic precursors by the chemical industry, as well as to recover the mineral fibres as a reusable reinforcement in new composite parts. The consortium works on defining the best conditions for recovering products of highest possible commercial value.

- **Description of the work performed since the beginning of the project and the main results achieved so far**

In a first step, the main composite waste resources in Europe have been identified. Production waste represent the most reliable source, with volumes of 40 to 45 kt/year in Europe. End-of-life boats are another interesting source, with around 10kt/year and a high need of recycling. End-of-life vehicles represent around 9kt of waste per year, but the dismantling of the composite components is complex.

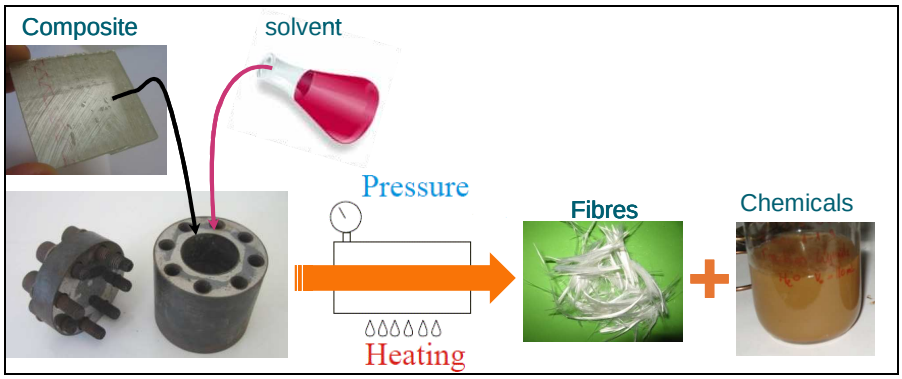
Boat hulls: one of the best sources of composite waste

A solvolysis laboratory prototype reactor has been designed and built. Influent process parameters are: temperature, duration and composite mass/water volume ratio. Tests have been carried out in order to determine the sets of parameters leading to the best recovered products.

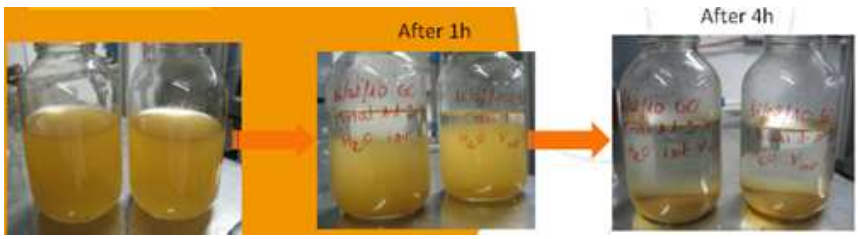


Laboratory prototype solvolysis reactor

First results show that solvolysis allows to remove up to 90% of the resin, to retrieve a liquid containing potentially interesting chemicals, and to recover fibres with medium mechanical properties. The products obtained, in solid and liquid phases, have been analysed to assess the reuse opportunities considering their quality and quantity, and their properties compared to original raw materials.

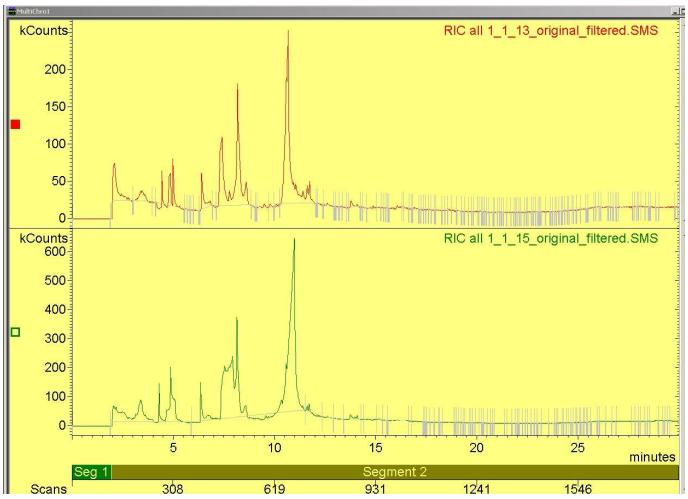


The solvolysis process



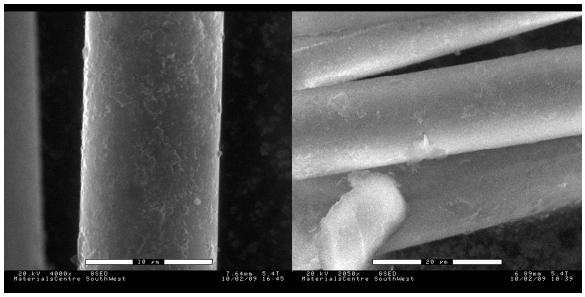
Liquid fraction retrieved after solvolysis

The liquid fraction appears to contain chemicals of potential commercial value like benzoic acid, benzaldehyde, isopropyl phenyl ketone, methyl ethyl ether, methyl isobutyl ether and benzene acetaldehyde.



Chromatographs:
identification of chemical components in the liquid fraction

The analysis of the fibres, based on the characterisation of mechanical properties, deterioration, contamination, surface quality, size, shape, etc., helps to evaluate the reuse possibilities and the best reaction parameters. Results show that the mechanical properties degrade at high processing temperatures and with longer reaction times. The cleanest recovered fibres present very few residues of the original surface coating of the virgin fibres: the surfaces would likely need to be refunctionalised before reuse into new composites.



ESEM micrographs of recovered fibres

In parallel to trials and analyses, dissemination and publication on first achievements have been carried out towards the scientific community and the composite industry in order to stimulate the interest of potential users of this technology.

Communication on the BPF web site:
http://www.bpf.co.uk/Innovation/Projects.aspx#EURECOMP

- **Expected final results and their potential impact and use (including the socio-economic impact and the wider societal implications of the project so far)**

The new recycling possibilities offered by the solvolysis will help the European composite industry to comply at lower cost with the waste regulations. It will help to emove barriers to further exploitation of composites, and on medium term to prevent the likely shift of the European composite industry to countries with less stringent waste regulations, thus safeguarding jobs.
From a wider societal point of view, the project will allow to reduce the overall environmental impact of composite waste and improve quality-of-life of European citizens.