



The BUILD-LIMONENE project develops building materials from CO2 emissions and citrus food waste

The BUILD-LIMONENE project has advanced the transformation of food waste and greenhouse gases to produce additives and biodegradable materials for low carbon footprint in the construction sector. This research is funded by the Valencian Innovation Agency (AVI) and the European Union, and has collaboration with the Institute of Chemical Technology (ITQ), Zuvamesa, Laurentia Technologies and Lamberti Iberia.

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The BUILD-LIMONENE project has developed new sustainable, biodegradable, safer and more energy efficient building materials as a real alternative to existing materials on the market, most of these are obtained from fossil sources and non-sustainable processes.

The technology developed in BUILD-LIMONENE contributes to the recovery of industrial waste from the food sector, especially from citrus food residues such as oranges and carbon dioxide (CO₂) emissions generated by industries in the Valencia region, for example in the ceramic sector. We have succeeded in developing innovative and sustainable formulations from the described waste and CO₂ that allow the production of polycarbonates, one of the most used polymers in the construction sector. The polycarbonate developed has been evaluated as a raw material for construction foams and coatings.

Zuvamesa, a company specialized in the production of citrus juices, has carried out a process of extraction of high purity natural oils (more than 90%) from different varieties of Valencian orange/mandarin, which are the starting point for obtaining the polycarbonate described.

The study carried out has shown that it is possible to obtain a greater quantity of these oils from the orange/mandarin variety, and establish a methodology for high-yield extraction and purification using semi-industrial equipment



Figure 1: Mandarin essential oil

These oils have been treated, in particular oxidised, to adapt their chemical structure for the formulation of the polycarbonate of interest.

This work, carried out jointly by the Instituto de Tecnología Química (ITQ, UPV-CSIC) and Laurentia Technologies, a company specializing in the synthesis and manufacture of nanomaterials, has enabled the development of high efficiency processes even at pilot plant scale by selecting the most suitable catalyst and process conditions.



Figure 2: Polycarbonate obtained from mandarin oil and CO₂

AIMPLAS, Instituto Tecnológico del Plástico, has obtained the polycarbonate from treated citrus oils and CO₂ emissions only. The desired polycarbonate with a yield of more than 85% at pilot plant scale without the presence of impurities has been obtained from a catalytic reaction process.

From this polycarbonate, AIMPLAS has developed a formulation that has allowed to obtain foams with high speed of foaming and characteristics suitable for use as insulation material in the construction sector. Lamberti Iberia, a manufacturer of polyurethane chemicals and emulsions, has advanced the development of formulations for inorganic floor coatings from this polycarbonate.



Figure 3: BUILD-LIMONENE insulation foams for construction

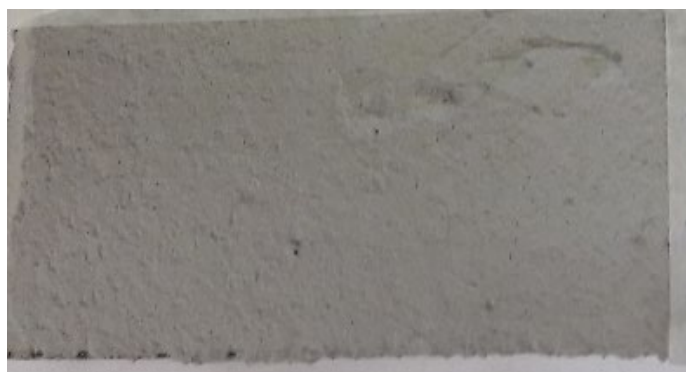


Figure 4: BUILD-LIMONENE PUD emulsion for construction



BUILD-LIMONENE project is aligned with the Circular Economy conclusions of the Strategic Committee for Specialized Innovation (CIEI), which include the development of materials including CO2 and food waste applied in the construction industry to reduce its carbon footprint. BUILD-LIMONENE is also aligned with the main concepts of the Intelligent Specialization Strategy (S3) of the Valencian Community, which is coordinated with the Conselleria de Innovación, Industria, Comercio y Turismo.