Fish and fish oils are excellent sources of omega-3 long-chain polyunsaturated fatty acids (PUFAs), especially eicosapentaenoic (EPA) and docosapentaenoic acids (DHA). EPA and DHA have been associated with several health benefits related to the brain, cardiovascular and kidney functions as well as to inflammatory and immunological responses. PUFAs multiple bonds’ chemical nature makes them highly unstable and easily oxidizable. Their oxidation contributes to off-flavors in foods and their products (e.g. hydroperoxides and aldehydes) have also been associated with harmful health effects. Value-added strategies to stabilize PUFAs present in fish oils such as the application of antioxidant extracts have gained popularity. Acorn is a fruit of Quercus coccifera L. (kermes oak) species, reported as a potent natural antioxidant with a high total phenolic content.

The results suggested some variations in both (saturated) and (unsaturated) fatty acids. However, these variations were more evident in long-chain unsaturated fatty acids: oleic acid (omega-9), LA (omega-6), ALA (omega-3), C18:2 n-6 c11,20, c18:1 n-9, arachidonic acid (omega-6), EPA, DPA and DHA - which were more incident in acorn extract-treated sample. In the antioxidant-treated sample, the EPA had a concentration of 115.7 µg mL⁻¹ and DHA of 28.4 µg mL⁻¹, in contrast to 0.25 and 0.0 µg mL⁻¹, respectively, in the control sample.

The results indicated a decrease in the oxidation index with acorn extract treatment. In order to identify and quantify the impact of antioxidant extract (mainly on omega-3 long-chain PUFAs concentration), the fatty acids profile of sardine cooking water was monitored.

The intake of fish oil supplements has been increased due to their rich omega-3 long-chain PUFAs nutritional composition and consequent health effects. According to the European Food Safety Authority, the intake of 250 mg per day of EPA and DHA is recommended for the maintenance of general cardiovascular health in healthy children and adults. It is also recommended an intake between 2 and 3 g per day to maintain normal blood pressure and triglyceride levels.

Although their high nutritional value, PUFAs are highly susceptible to oxidation and antioxidants have been applied to try to stabilize the PUFAs profile. Based on a circular economy valorization approach, the potential oxidative inhibition of an acorn extract on wastewater from sardine cooking (a rich source of omega-3 long-chain PUFAs) was investigated. The preliminary results indicated that acorn extract may reduce the peroxide index and prevent PUFAs oxidation.

As future work, stability tests will be carried out to define the potential applications of this omega-3 long-chain PUFAs rich oil (based on wastewater from sardine cooking) as a food ingredient or in the incorporation and development of a fish oil nutritional supplement.