

Recycling wastes from *Rubus idaeus* by-products: Sourdough bread production as a new end-use of exhausted seeds still containing active compounds

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In the past few years, in light of the European Commission's directives on environmental sustainability, the food industries and academic research institutes focused their attention on the use of plant waste and by-products as ingredients to improve the nutritional value of foods. In this work, the agro-industrial waste from cold pressing of *Rubus ideaus* seeds (WRS) was explored as a valuable food ingredient in bread production. Bread making trials were performed under laboratory conditions using a mix of wheat flour and semolina (1/1) and sourdough as fermenting agent. Two experimental bread productions (5-WRS and 10-WRS) were obtained replacing wheat flour/semolina with WRS at 5 and 10 % (w/w), while control production (CTR) was WRS free. WRS did not negatively affect sourdough LAB starter development and their cell densities reached almost 10^8 CFU/g at the end of fermentation. Illumina technology identified 14 taxonomic groups, and lactobacilli constituted the major group of the mature sourdough (75.91 % of relative abundance (RA)) and doughs (82.08 – 88.76 % RA). WRS decreased the volume and increased crust and crumb redness of the final breads. The replacement of wheat flour/semolina with WRS at 5 and 10 % (w/w) significantly increased the functional value of breads, in terms of content of polyphenolic compounds, proanthocyanidins content and antioxidant activity. In particular, these functional properties increased until 25 % in bread, confirming the thermal stability of WRS. The addition of WRS did not spoil the sensory traits of breads, but the highest values of overall satisfaction were displayed by 5 % (w/w) WRS enriched breads. This work clearly indicated that the addition of WRS in bread production represents a promising strategy to increase the antioxidant activity in cereal-based fermented products.