

Pulsed-electric-field (PEF) application to enhance hydration and amylolytic capacity of wheat and barley during malting process

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Wheat and barley are the most commonly malted cereals worldwide. They have been widely used in different food sectors as starchy ingredient containing important endogenous enzymes such as amylases. Because malting is a time-consuming process, this work proposed the application of pulsed electric field (PEF) technology to enhance the grains hydration by improving the aleurone layer permeability to water and to accelerate the amylase development. For this, a two-step hydration procedure was studied for wheat and barley with an interval of rest under air in-between. PEF treatments (3 kV·cm⁻¹ and total energy applied of 9.9 and 19.8 kJ·kg⁻¹) with 100 or 200 pulses were applied at the beginning or after the first hydration cycle. Using the Weibull exponential model, the first and second hydration curves could be accurately described with a $R^2_{adj} > 0.98$ and a $RMSE < 0.0092$. The more intense PEF treatments enhanced hydration rate of wheat up to 25% as well as the water holding capacity PEF was applied before the first hydration cycle. Similar behavior was observed when 100 pulses were applied in barley grains, but an enhancement of 10%. The application of 200 pulses in barley grains did not caused any improvement and also caused significant damages to the sprouting process. After drying the post-sprouted cereals for 24 h, the alpha- and beta-amylase activity determined for PEF-treated wheat and barley malts showed up to 2-folds the values found for untreated grains. Both alpha- and beta-amylase could be modulated according to the PEF treatment intensity. Therefore, PEF treatments can be used as a clean emerging technology to enhance wheat and barley hydration step aiming at malting process. Moreover, the proposed PEF-treatments represent viable alternatives to produce malted ingredients not only in a faster way but also with improved functional properties for the most different food applications, as brewery and baking.