

Effect of Pulsed Electric Field-assisted vinification on New Zealand Sauvignon Blanc grapes: Using GCxGC-qMS analysis as an untargeted global metabolomics approach

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Pulsed Electric Fields (PEF) processing applies high voltage electric pulses across biological materials placed between two conducting electrodes for short times (typically in the range of micro- to milli-seconds). PEF, at electric field strengths above 0.3-0.5 kV/cm, can lead to irreversible cell membrane electroporation of plant tissues and facilitate the release of cell contents. In wine making, this processing can be used to enhance grape maceration. Since PEF might change the global metabolite profile of macerated grapes and ultimately the resulting wine. The aim of this research is to study the untargeted metabolite profile of wines produced from untreated and PEF-treated Sauvignon Blanc grapes, using comprehensive two-dimensional gas chromatography-mass spectrometry (GCxGC-qMS). As a complement, a targeted analysis of specific phenolic compounds using reversed phase HPLC-DAD was performed. This is the first time that the effect of PEF treatment on metabolite extraction during vinification has been investigated for white grape variety.

The results showed that Sauvignon Blanc wines produced from untreated and PEF-treated grapes had distinctly different metabolite profiles. For example, the concentration of the organic acids malic, citric, malonic, shikimic, α -ketoglutaric, L-threonic, fumaric, glutaric, citramalic, isocitric acids and the phenolics protocatechuic, vanillic, syringic, chlorogenic and ferulic acids in the wine obtained from PEF-treated grapes was higher, as compared to the control wine. The amino acids composition was not greatly affected by the PEF pre-treatment of grapes; however the sugars glucose and fructose were found at lower concentrations in the wine from PEF-treated grapes.

Overall, the global metabolomics-based approach was found to be a suitable technique for detecting and identifying changes in either targeted or non-targeted metabolites in the wine produced from PEF pre-treated grapes. Therefore, this technique offers an opportunity to further understand how these changes at the molecular level could impact on the characteristics of wine.