Untargeted HPLC-UV-FLD Fingerprinting for the Characterization, Classification and Authentication of Tea

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Tea (*Camellia sinensis*) is one of the most popular beverages, commonly consumed all over the world. Depending on the fermentation process, tea leaves can be categorized into three major groups: unfermented green tea, semifermented Oolong tea, and fully fermented black tea. The latter accounts for over 80% of worldwide production. The quality of tea products is determined by color, freshness, strength, and aroma. Phenolic and polyphenolic components contribute to the color and taste, whereas volatile components are directly related to the aroma. Unfortunately, food fraud is increasing globally. The widespread adulteration is the main concern for commercial functional tea extracts and tea-based nutraceuticals on the market. Especially for powdered extracts, the product quality of functional tea extracts varies highly on the market. The growing demand and interest in functional tea extracts are causing the proliferation of frauds that can seriously affect public health. Chicory, husk of pulses, and cereal starch are non-permitted materials typically employed as adulterants in tea extracts.

The aim of this work was to develop an efficient untargeted high-performance liquid chromatography with ultraviolet and fluorescence detection (HPLC-UV-FLD) method in combination with chemometrics to address the characterization, classification, and authentication of tea samples, together with possible adulterants such as chicory extracts. A reversed-phase chromatographic separation was optimised, using a C_{18} column, and 0.1% formic acid aqueous solution and acetonitrile as the mobile phase components. The proposed methodology was applied to 87 tea samples, differing in variety and production region, and 12 chicory samples. In any case, the sample treatment consisted of sample infusion with hot? water and filtration, and the obtained HPLC-UV-FLD fingerprints were subjected to principal component analysis (PCA) and partial least squares regression-discriminant analysis (PLS-DA) chemometric methods. Perfect discrimination was achieved between different tea varieties and chicory demonstrating that untargeted HPLC-UV-FLD fingerprints can be proposed as good sample chemical descriptors to assess tea authentication and to prevent frauds dealing with adulteration with chicory.