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Sewage sludge biochar as green d–SPE adsorbent in QuEChERS clean-up process for the multi-residue LC-MS/MS analysis of emerging micropollutants in edible crops

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QuEChERS extraction is a widely used method for the multi-residue analysis of micropollutants in food matrices[1]. Due to the complexity of these matrices, QuEChERS methods usually require a clean-up stage of the extract, which in most cases uses the dispersive solid-phase extraction (d-SPE) technique, exploiting various types of materials (e.g., styrene-divinylbenzene and graphitized carbon black), characterized by significant costs. For this reason, a recycled carbonaceous material derived from the pyrolysis of sewage sludge (BC) was developed as a green alternative to commercial d–SPE adsorbent and applied to the clean-up procedure of high-pigmented edible crop extracts (i.e., rocket, tomato, and strawberry) for the determination of a wide variety of contaminants of emerging concern (CECs), such as pharmaceuticals, sunscreen agents, and PFASs listed in recent European decisions[2]. The use of 50 mg of BC proved to be reliable and cost-effective for the d–SPE clean-up of 23 analytes belonging to the aforementioned classes, being capable of reducing the matrix effect to less than |27%|. Although there were some limitations in recovering a group of CECs, BC allowed for achieving pseudo-quantitative recoveries and insignificant matrix effects for 8 pharmaceuticals, 1 sunscreen agent, and all 8 perfluoroalkyl substances studied. Furthermore, combining 5 mg or 10 mg of BC with 20 mg of styrene-divinylbenzene clean-up performances were improved, achieving quantitative recoveries for most CECs with matrix effects < |29%| (see **Figure 1**). The proposed analytical methodology was applied to the analysis of impacted crop samples, providing method sensitivities comparable to or lower than the limits proposed by the European community.

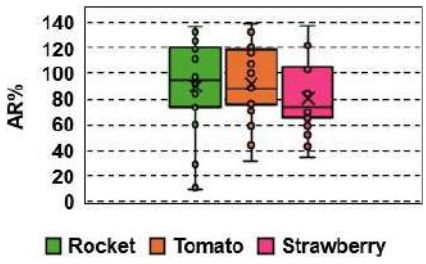

Figure 1: Mean apparent recoveries (AR%) of target CECs in food samples after d-SPE clean-up.

References:

[1] L. Kim, D. Lee, Trends in Environmental Analytical Chemistry 2019, 22 e00063.
[2] C.V.A. Scordo, L. Checchini, Journal of Chromatography A 2020, 1621 461038.