

## Biochar from sewage sludge as a sustainable and green d-SPE phase in QuEChERS purification procedure: first application on the LC–MS/MS analysis of emerging micropollutants in edible crop samples.

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The QuEChERS extraction method is widely employed for multi-residue analysis of micropollutants in food matrices [1]. Due to the complexity of these matrices, QuEChERS procedures typically require a clean-up step, which is commonly performed by dispersive solid-phase extraction (d-SPE), using proper sorbent materials (e.g., primary secondary amine and graphitized carbon black). However, these sorbents are often quite expensive, thus impacting on the overall applicability of the procedure. Therefore, a carbonaceous material from pyrolysis of sewage sludge (i.e., a biochar, BC) was developed as an eco-friendly and cost-effective alternative to commercial d-SPE adsorbents. BC was applied to the clean-up of high-pigmented edible crop extracts (i.e., rocket, tomato, and strawberry) for the determination of various contaminants of emerging concern (CECs), including pharmaceuticals, sunscreen agents, and perfluoroalkyl substances (PFASs) listed in recent European regulations [2]. The use of about 25 mg of BC per mL of extract proved to be effective for reducing absolute matrix effect, |ME|, to less than 27% in the determination of 23 CECs in the aforementioned edible crop matrices. In particular, BC behaved similarly to GCB, the latter being a high cost “noble” material for QuEChERS applications, showing some limitations due to the adsorption of certain CECs. However, it is remarkable that BC enabled pseudo-quantitative recoveries and negligible |ME| for 8 pharmaceuticals, 1 sunscreen agent, and all 8 PFASs studied. Furthermore, the combination of 5 mg or 10 mg of BC with 20 mg of styrene-divinylbenzene enhanced clean-up performance, leading to high recoveries for most CECs, with |ME| well below 30%. This analytical method was successfully applied to the analysis of crop samples obtained under irrigation with treated wastewater, with sensitivities comparable to or lower than the limits set by European regulations, thus achieving interesting environmental information.

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