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Abstract

Green and Sustainable Extraction of Bioactive Compounds from *Salicornia ramosissima* †

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Abstract: Halophytes are salinity-sensitive plants that tolerate extremely high salt concentrations, and are mainly found in saltmarshes and coastal areas worldwide, including Portugal [1]. Halophytes, such as *Salicornia* spp., are used by humans for commercial, ecological and gastronomic purposes [2]. Inside this genus, *Salicornia ramosissima* is of particular interest, being considered an alternative to salt [3]. The valorization of *S. ramosissima* may be a sustainable and environmentally friendly way to obtain extracts, which may be of interest for the nutraceutical industry. Nevertheless, extraction is a key step in acquiring bioactive compounds from plants, with emphasis on the extraction technique and solvent employed, which should maximize the extraction yield [4]. The aim of this study was to recover bioactive compounds from *S. ramosissima* by conventional extraction (CE) and Microwave-assisted extraction (MAE) techniques using water as an extractor solvent. In this study, the total phenolic and flavonoid contents (TPC and TFC, respectively) and antioxidant/antiradical activities (through FRAP and ABTS assays), as well as the phenolic profile and the in vitro effects on intestinal cells, were screened. Briefly, CE was performed as a decoction preparation while MAE was executed at selected temperatures (72–94 °C) for 1 to 5 min, with constant medium stirring. After the extraction, samples were filtrated and lyophilized for further assays. The values of TPC ranged between 8.34 and 15.02 mg of gallic acid equivalents (GAE)/g for CE and MAE extracts, respectively. Similarly, CE extract exhibited the highest TFC value (8.44 mg of catechin equivalents (CAE)/g). Regarding the ABTS and FRAP assays, the MAE extract showed the highest values (60.61 µmol FSE/g dw and 16.06% inhibition for FRAP and ABTS assays, respectively). On the other hand, the total amounts of phenolic compounds identified and quantified in both extracts were similar, the phenolic acids and flavonols being the principal constituents. For both extracts, myricetin was the compound present in the highest amounts (0.4250 and 0.4655 mg myricetin/g dw for CE and MAE extracts, respectively), and gallic acid was the major phenolic acid present in the extracts (0.2105 and 0.1553 mg gallic acid/g dw for CE and MAE extracts, respectively). The cell effects demonstrated that neither extract led to a decrease in HT29-MTX viability. In the Caco-2 cell line, only the highest concentration of MAE (1000 µg/mL) led to a decrease in viability (86.55%). In this sense, *S. ramosissima* extracted by CE or MAE can be classified as non-toxic and rich in bioactive compounds. However further studies, such as in vitro intestinal permeation assays and in vivo studies, are needed to underline this potential.

Keywords: conventional extraction; microwave-assisted extraction; bioactive compounds

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