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Editorial

Green Separation and Extraction Processes: Part I

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Supercritical fluid extraction comprises a known technology applied to obtain volatile compounds from flowers, i.e., tuberose (belonging to the Asparagaceae family), that could be used for example in the perfume or fragrance industry [1]. The cocoa shell—a residue of low commercial value—represents an alternative for obtaining substances of added value for the food and pharmaceutical industry, including fat, theobromine and caffeine [2]. An attempt to reclaim some value from the residues generated by the citrus processing industry was conducted in order to identify and extract the existing bioactive compounds, i.e., the flavanone glycoside hesperidin [3]. The use of deep eutectic solvents (DESs), being environmentally friendly, with low cost etc., were applied as an extraction media of hesperidin [4]. Various extraction methods (ultrasonic-assisted, microwave-assisted, enzyme-assisted and hot water) were tried for polysaccharides from edible mushrooms and their structural characteristics were analyzed [5]. A batch extraction process of oil from palm kernel meal using subcritical water, at moderate temperature and pressure conditions, was published [6].

Essential oil of black pepper was extracted by a hydrodistillation process, for applications such as in the manufacturing of insecticides and air deodorizers [7]. Essential oils from agarwoods were extracted (with the above process, too) and their chemical composition were determined, using gas chromatography–mass spectrometry techniques [8]. Seeds of the Fabaceae family—following extraction—were characterized for various constituents as antioxidant sources for use in food or cosmetics [9]. In addition, the extraction of anthocyanin (being a family of flavonoids, a natural pigment of plant origin) colorant from karanda fruit was carried out and optimized for its total content, stability and antioxidant evaluation [10]. Microwave-assisted extraction was used to obtain the total phenolic and flavonoid content yield from *D. indica* (i.e., a reforestation species for environmental services in Vietnam) [11]. The recovery of bioactive compounds, especially flavonoids, from corn husks by an enzyme-assisted extraction process, consisting of a pretreatment of the plant material with cellulase followed by solvent extraction with aqueous ethanol was undertaken [12].

A new approach for the production of phenolic compounds from soybean sprouts has also published, under different extraction conditions [13]. The bioactivity of plants has been acknowledged worldwide throughout centuries; for example, aqueous preparations of *Melissa officinalis* L. (an edible perennial herb of the Lamiaceae family) were considered to be remarkable sources of phytochemicals with nutritional importance [14]. Essential oils extracted from different parts of sour orange *Citrus aurantium* were elsewhere studied through gas chromatography coupled with mass spectrometry [15]. DESs, formed by simply mixing two or more components, showed having advantages for applications in health-related areas [16]. An appropriate extraction process from the seeds of *Madhuca ellitica* was performed; the evaluation of the seed polar lipid profile will be helpful for developing the potential of this tree for nutritive and industrial uses [17].

The extracts from mulberry leaves were separated and purified via high-speed counter-current chromatography in order to obtain high-purity flavonoid products [18]. Brewer's spent grain contains also significant amounts of bioactive compounds of interest to the pharmaceutical, cosmetic and food sectors (i.e., phenolic antioxidants), which are possible to recover via a mild and green water-organic solvent extraction process [19]. New sources of biofungicides or bactericides are being developed to overcome the toxic effects of conventional pesticides [20]. Caustic extraction in a total chlorine free bleaching sequence was investigated for wood chips pulp to make viscose fibers, with complementary utilization of viscose lyes and hemicellulose as a co-product [21]. A feasible approach was established for the preparation of desired neoagaro-oligosaccharides with different degrees of polymerization by regulating the enzymolysis time of β-agarase from marine bacteria [22]. Macroporous resins were screened on their adsorption and de-adsorption characteristics for the amygdalin (a characteristic component of the apricot kernels) in the debitterizing wastewater concentrate [23].

Biodegradable and non-toxic nanoparticles have been used as a solution for the effective encapsulation of antioxidants and oxidation-susceptible compounds, mainly due to their advantages over other delivery systems and colloidal carriers; the incorporation of carotenoids extracted from gac fruit oil into solid lipid nanoparticles was tried for edible products and cosmetics [24]. The production of silver nanoparticles from bilberry or red currant waste extracts was also studied [25]. Nano-sized metals have been introduced as a promising solution for microbial resistance to antimicrobial agents [26]. Fungal infections of the mouth and skin are common diseases in tropical developing countries; the antifungal activity of *E. divinorum* root bark was reported [27]. The effects of essential and recovery oils from *M. chamomilla* (fresh flowers) on the growth of certain fungi, isolated from cultural heritage, were explored [28]. The enzyme-assisted aqueous extraction process is an environmentally friendly strategy that simultaneously extracts oil and protein from several food matrices, i.e., from almond flour [29].

Boric acid extraction from the naturally occurring mineral tincal ($Na_2B_4O_7 \cdot 10H_2O$) was attempted utilizing ultrasonic irradiation [30]. Copper, lead and zinc in a flotation concentrate obtained by bulk flotation of low-grade ore was effectively separated by an oxidizing roasting–leaching–electrowinning process [31]. Low-intensity magnetic separation was combined with reverse flotation to increase the iron and reduce the phosphorus contents of (suspended flash magnetic) roasted product from high-phosphorus oolitic iron ore [32]. Elsewhere, ultrasound was used for the extraction of polysaccharide gums [33]. Pectin, having numerous applications in the food industry as technological adjuvants, was extracted from an apple hybrid (developed in Romania) by applying an ultrasonic treatment [34].

Caustic extraction in a total chlorine free bleaching sequence was investigated for wood chips pulp to make viscose fibers, with complementary utilization of viscose lyes and hemicellulose as a co-product [21]. The separation by a solvent extraction process of noble metals from concentrated hydrochloric acid solutions of secondary resources was developed, avoiding the scrubbing stage [35]. The triethylene glycol dehydration/absorption process in offshore natural gas production based on supergravity technology was discussed, in view of the limited space of the platforms [36]; Higee technology has been applied to many processes including (dissolved-air) flotation. The latter can go green [37]. Foam fractionation was attempted to separate anthraquinones, using proteins in the aqueous extract of Semen Cassiae (a traditional Chinese medicine) as collectors; the Stem–Volmer analysis was used to investigate the interaction [38].

The performance of anaerobic digestion of the organic fraction of municipal solid wastes (for waste-to-biogas conversion) was compared in wet- and dry-type reactors; the management of municipal solid wastes represents a challenge in view of sustainable economy [39]. Selected biological methods intended for the removal of different air pollutants, especially of odorous character [40]. Bioethanol is considered one of the promising substitutes for fossil fuels; the alternative techniques for its recovery were reviewed [41]. Integrated fermentation/separation coupled systems have recently received increased attention. Natural oils extracted from leaves, foliage and flowers were studied for their toxicity and insecticidal activities against insects; the post-harvest losses of stored cereals are caused, among others, by insect damage [42]. Essential oils from different fruits and leaves were assayed for their insecticidal activity against red flour beetle and *Culex* mosquito larvae [43].

This Special Issue on "Green Separation and Extraction Processes" sought (and finally we believe succeeded) to present hereby high-quality works and topics (not only those) focusing on the latest novel wastewater processes. The first part of this Special Issue is consisted of 53 works (49 research articles; 2 review papers, 1 communication; 1 case report) from distinguished authors worldwide [1–53]. Many authors, whom we—as editors—thank very much, coming from various countries contributed marvelously in this first part of the present Special Issue. All the aforementioned and much more were dealt in detail. Certainly, the field of "green separation and extraction processes" is vast; the present hopefully adds one more useful contribution.

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