ABSTRACT

Seaweeds, a diversified group of photosynthetic organisms, possess diversified functional qualities like nutraceutical, cosmeceutical, functional foods, biofuels feedstock, low cost biosorbent, etc. Malaysia harbours a large number of marine seaweeds. A healthy initiative in the systemic research on this resource has been lacking over the decades. In the present study, two seaweeds namely *Eucheuma* sp. and *Kappaphycus* sp. have been evaluated to explore their bio-economic importance with respect to biodiesel feedstock, nutraceutical composition, pharmacological and biosorbent potentials following molecular identification. The two seaweeds were identified as *Eucheuma denticulatum* and *Kappaphycus* sp. using 28S rRNA molecular marker. Some important physico-chemical properties of biodiesel produced from the experimental seaweeds were determined through linear relationships based on the fatty acid methyl ester compositions. Although the produced biodiesel satisfied different international quality standards, the amount of yielded total lipid (1.19 – 1.57% dw) was unsatisfactory to consider the seaweeds as feasible biodiesel feedstocks. Both the seaweeds were found to be a novel source of carbohydrates (64.0 – 69.2% dw), vitamin A (14 – 20 IU/100 g dw), vitamin E (0.5 – 2.4 IU/100 g dw), and some essential micro-minerals. They were found to contain high level of macro-minerals (Na, K, Ca and Mg) and low level of protein. The Na/K ratio in both the seaweeds was fairly high that can be detrimental. Amino acid profile showed that they were not a good source of high quality protein as none of their protein contains all the essential amino acids in the required amounts. The experimental seaweeds were found pharmacologically important due to the presence of a significant amount of different phyto-nutrients like phenolics (34.98 – 48.31 mg GAE/g extract), flavonoids (6.53 – 27.25 mg QE/g extract), condensed tannin (346.67 – 486.67 mg GAE/g extract) and pigments including carotenoid. The methanolic extract of the seaweeds also exhibited fairly (DPPH$^{\bullet}$ scavenging activity, metal ion chelating activity) to good (ABTS$^{\bullet+}$ activity, antioxidant activity) antioxidant potentials. The present study also revealed that the dried biomass of the experimental seaweeds may be used as low-cost biosorbent for the treatment of waste waters containing heavy metals. The experimental data from biosorption study were evaluated by different isotherm and kinetic models following error functions. The maximum biosorption capacity of the dried biomasses was found in the range of 22.17 – 81.97, 19.49 – 66.23, 16.92 – 51.02 and 16.23 – 43.48 mg/g for Pb^{2+}, Cu^{2+}, Fe^{2+} and Zn^{2+}, respectively. Biosorption kinetics was rapid while the adsorption process was found feasible, spontaneous and endothermic. Carboxylic acids, sulfonic acids and sulfonate groups were revealed as the

functional groups involved in the metal biosorption process. The present study proved that *E. denticulatum* and *Kappaphycus* sp. of Malaysian origin are the two important bioresources that may be used as the need-based functional foods and antioxidant components for human health benefits as well as low cost biosorbents for heavy metals removal from waste waters. Further studies with the available and unexplored seaweeds of Malaysia are highly warranted.