Palmaria palmata in food formulations as natural antioxidant and functional ingredient

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May 2009

Dulse - Icelandic Food Culture - Food Applictions

P. palmata **(dulse) is one of the most abundant edible seaweeds in Iceland. Evidence dated back to the 12th century indicates that dulse was considered an important source of food supply when food variety was scarce. Dulse was then consumed along with dried fish and butter or cod liver oil, but also used in porridge with pot barley and in dulse cakes.**
Nowadays, dulse is mainly consumed as snacks and sold in health stores, but there is growing awareness that it should be utilized more as a source of important nutrients.

The aim of the collaboration of the companies Syni ehf, Hollusta úr hafinu and Íslensk fjallagrös in the preliminary project "Icelandic Food Culture with Seaweed and Plants" (funded by the Technological Fund of Rannís) was to explore possibilities in further cooperation of SME´s in harvesting, up-scaling of processing, product development, risk assessment and marketing of food products based on seaweeds and Icelandic plants.

Figure 1. Haddock pudding with dulse has improved waterbinding properties and seaweedy, fresh marine flavor

Figure 2. Saladdressing with dulse in olive oil is an interesting, tasty and healthy choice

Seaweeds which are sometimes referred to as sea vegetables are interesting addition to the diet, that increase the level of carbohydrates and fibers. To enhance public knowledge and increase awareness of this underutilized raw material, new recipies were developed (Figs. 1 and 2). They will be implemented in training courses at Sýni on cooking and utilisation of seaweed as a functional ingredient in food formulations.

The initiatives of the small companies to strengthen their collaboration needs to be stimulated further to ensure sustainable and efficient utilization of this nutritious and health promoting raw material.

Dulse for use in Functional Foods and Neutraceuticals

Nutritional quality and medical benefit of dulse is a common knowledge. *P. palmata* has potential applications in the food and nutraceutical industries based on its content of dietary fibers, minerals, high protein content, as well as hydrophilic antioxidant compounds including L-ascorbic acid, glutathione (GSH), polyphenols and mycosporine-like amino acids (MAAs)[3,4]. Water and organic solvent extraction which are the most frequently used methods for extraction of natural antioxidants from various plant materials were applied to screen for antioxidant activities in various Icelandic seaweeds[2].
Because of the increased public awareness and the growing environmental and safety concerns of using large amounts of organic solvents, the alternative application of enzyme assisted extraction of hydrophilic antioxidant compounds from the red seaweed *P. palmata* was explored in the "Gull í greipar Ægis" project, funded by AVS.

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Figure 3. P. palmata (dulse) (Picture: Karl Gunnarsson)

Enzymatic Extraction of Antioxidants from Dulse

The results of *in vitro* tests (DPPH radical scavenging activity, ORAC and ferrous ion-chelating ability) showed that enzymatic hydrolysis using commercial enzymes (proteases and carbohydrases) was effective in enhancing the extraction of polyphenols and other active compounds from *P. palmata.* The crude polyphenol fraction of Umamizyme extract was superior to the other fractions in terms of peroxyl radical scavenging potential, whereas the crude polysaccharide fraction was more effective for chelating ferrous ions(Table 1) .

Results indicate that there are enormous possibilities in developing valuable natural antioxidants from seaweed. Further studies are ongoing to verify the antioxidant activity in food model systems.

Table 1. Antioxidant activity of crude polyphenol, polysaccharide and LMW aqueous fractions from Umamizyme extract of P. palmata evaluated by vitro tests (From: Wang et al, 2009[1])

Sample	DPPH scavenging[a] (ARP)	ORAC[b] (µmol TE/g extract)	Fe^{2+} chelating ability (%)
Crude polyphenol fraction	5.4 ± 0.3	629.5 ± 15.2	57.2 ± 2.9
Crude polysaccharide fraction	4.8 ± 0.3	102.9 ± 2.8	94.3 ± 1.8
LMW aq. fraction (<5 KDa)	2.4 ± 0.1	130.7 ± 3.4	20.5 ± 1.6

Each value is expressed as means +/- SD (n=3).
[a] ARP, antiradical power (ARP=1/EC_{50}), EC_{50}: concentration of extract (mg/ml) required to scavenge 50% of the DPPH• in the reaction mixture.
[b] ORAC, oxygen radical absorbance capacity; TE, Trolox equivalents.

References

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