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Pomegranate Extracts as an Antioxidant in Fishery Products

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Abstract

Fish and fishery products always have a high demand in the World market. In last few years, there is an increasing knowledge on the importance of n-3 PUFA in human physiology among people, and fish have high contents of this type of fatty acids and this gives more importance of fishery products in human health and nutrition. One of the major drawbacks of these products is oxidation, and it leads to non-desirable off-flavour. There are many synthetic antioxidants are used to retard the oxidation in fishery products but the use of some synthetic antioxidants are restricted in many countries due to the undesirable health effects. Alternatively the use of natural antioxidants instead of synthetic compounds has great importance and many plant extracts have been used as natural antioxidants and pomegranate extracts are one among them. Pomegranate extracts at the higher concentration have the potential antioxidant effect equal to the synthetic antioxidant.

Introduction

Fish is a good source of high quality animal protein and gained importance in the human diet. The good cholesterol in fish, the n-3 PUFA and its effect in human physiology are equally important in human health. Oxidation of fishery products is one of the hurdles to extend the shelf life. Though synthetic antioxidants are used to reduce the oxidation in fishery products, they are not good to human health. The extracts derived from agricultural byproducts and plants have potential sources for natural antioxidants and those are better alternatives for the synthetic compounds. The addition of natural antioxidants in fishery products has substantial application in increasing consumer acceptability and also improves the stability of products. These natural antioxidants can be added to foods for human consumption because of their safety when compared to the synthetic one. Fruit peels which are usually considered as waste products from processing of agricultural items can offer more practical and economic sources of active antioxidants. Phenolic compounds are the main class of natural antioxidants and pomegranate is a very good source of it.

Pomegranate Peel

The pomegranate peel which is derived as a waste from juice vending shops has a rich source of antioxidants, phenolic compounds and flavonoids. It also possesses antibacterial and antifungal activity (Figure 1). Punicalagin which is a type of phenolic compound that is present in the highest concentration in pomegranates compared to most commonly consumed fruits. This punicalagin has potential antioxidant, antifungal and antibacterial properties. Pomegranate peels have higher antioxidant activity than arils

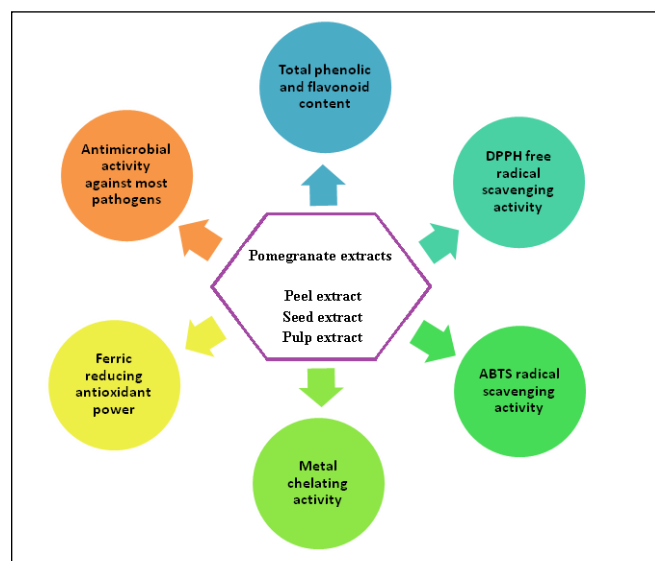


Figure 1: Various potential activities of pomegranate extracts (edible portion) due to the considerable amount of flavonoids and tannins present in it (Table 1). Pomegranate peels also possess wound healing properties, immune modulatory activity and antibacterial activity antiatherosclerotic and antioxidative capacities. Hence pomegranate (*Punica granatum*) is one of the healthiest fruits. The process of making juice from pomegranate fruit produces large amount of byproducts such as pulp, peels and seeds which account for 92% of the antioxidant activity associated with the fruit. So, pomegranate by-products can be used as a substrate to produce biologically active and nutritionally valuable compounds which can have a number of applications as food additives, functional food ingredients, nutraceuticals and supplements as phenolic-rich diets (Heena *et al.*, 2018).

Table 1: Antioxidant activities of pomegranate extracts

Properties	Results
Total phenolic content	Peel extract (PE) > Seed extract (SE) > Pulp extract (PuE)
Total flavonoid content	Peel extract (PE) > Seed extract (SE) > Pulp extract (PuE)
DPPH free radical scavenging activity	Peel extract (PE) ≤ BHA > Seed extract (SE) > Pulp extract (PuE)
ABTS radical scavenging activity	At higher concentration Peel extract (PE) ≤ BHA > Seed extract (SE) > Pulp extract (PuE)
Metal chelating activity	EDTA > Peel extract (PE) > Seed extract (SE) > Pulp extract (PuE)
Ferric reducing antioxidant power	At same concentration Peel extract (PE) ≤ BHA > Seed extract (SE) > Pulp extract (PuE)

Antioxidant Activity of Pomegranate Extracts

Lipid oxidation in fish oil can be strongly inhibited by alcoholic extract of pomegranate peel and it also enhanced the shelf life of anchovy oil. Pomegranate peels have the higher antioxidant property than the seeds, flower, leaf and have higher total phenolic content than the pulp. This antioxidant activity of pomegranate peel is due to its phenolic compounds in the form of anthocyanins, gallotannins, ellagitannins, gallagyl esters, hydroxybenzoic acids, hydroxycinnamic acids and dihydroflavonol. However, ellagitannins specified by ellagic acid, gallic acid and punicalagin are the main phenolics of the fruit. Most of the antioxidant activities, including radical scavenging ability, ferrous ion chelating and ferric ion reducing antioxidant power were associated with pomegranate peel extract. These activities are accredited to their hydrogen donating ability. It is a known fact that free radicals cause autoxidation of unsaturated lipids in food products. Contrarily, antioxidants can intercept the free radical chain of oxidation and donate hydrogen from the phenolic hydroxyl groups, so that to form a stable end product, that do not initiate or propagate further oxidation of the lipids. The pomegranate peel and seed powder extracts which are primary antioxidants acts as free radical inhibitors, thus suggesting their potential application as natural additives and functional food ingredients. Flavonoids are also known to be highly effective antioxidants by scavenging oxygen radicals. Moreover, the protective effects of flavonoids in biological systems are attributed to their capacity to scavenge free radicals, chelates metal catalysis, activate antioxidant enzymes, reduce alpha tocopherol radicals and inhibit oxidation (Khan *et al.*, 2017).

Antimicrobial Activity of Pomegranate Extracts

Gallic acid, ellagic acid and punicalagin also own antibacterial activities, in addition to their free radical-scavenging properties. It shows antibacterial activities against enteric pathogens such as *Escherichia coli*, *Salmonella* spp., *Shigella* spp., as well as *Vibrio cholera*. Phytochemicals present in the plants is the reason to prevent the growth of several pathogenic bacteria. Pomegranate extracts have the ability to inhibit a range of bacteria like, *S. aureus*, *E. coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Bacillus subtilis* and *Salmonella typhi* and regarding *S. aureus*, it is not only inhibiting the growth but also the production of enterotoxin. At low concentration pomegranate extract delay the growth in *S. aureus* and at high concentration it completely eliminates it. The water-methanol extract of pomegranate peel have antimicrobial activity against microorganisms, such as *Bacillus subtilis*, *Staphylococcus aureus*, *Yersinia enterocolitica*, *Listeria monocytogenes*, *Candida utilis*, *Saccharomyces cerevisiae*, and *Aspergillus niger* (Al-Zoreky, 2009).

Conclusion

Pomegranate peels and seeds are usually considered as byproduct wastes but it can be effectively used as natural antioxidants in fish and fishery products. It has high antioxidant properties as well as antimicrobial properties. It can be added with fishery products to retard the lipid oxidation and microbial growth, thereby enhancing the storage or shelf life of the products.

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