

Advanced Structured Materials

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Bioactive Natural Products for Pharmaceutical Applications

 Springer

Editors

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Chapter 21 Tannins and Polyphenols Extracted from Natural Plants and Their Versatile Application

Sovadeep Mal and Dilipkumar Pal

Abstract From the beginning of lives on earth, nature is contributing different products to the system constantly and endlessly. Plants synthesize a large number of organic compounds, which are commonly known as primary and secondary metabolites with various applications. Tannins are one of the secondary metabolites solely obtained from the natural or plant sources where it present in the woods, barks, leaves, fruits, cell sap or in vacuoles. Chemically, they are polyphenolic colloidal solutions with complex astringent properties and it has the ability to tan or convert the skin of animals into leather. Depending on the complexity of chemical nature, tannins are classified into two types i.e., hydrolysable tannins and condensed tannins. More than 8000 different tannins of free or bound forms have been detected which can be used in various sector. Despite of its astringent property, tannins and polyphenols can show their identity with different applications with properties like anti-oxidant, anti-inflammatory, anti-microbial, anti-aging, stomachic, cardio-tonic, diuretics, laxatives, hypoglycemic, anti-corrosive or in photography, food, nutraceuticals or cosmeceuticals. In this review, we discuss about different tannins and polyphenols obtained from different sources, their types, about important chemicals and their remarkable applications in different fields of the system.

Keywords Secondary metabolite · Colloidal solution · Tannins · Hydrolysable tannin · Condensed tannin · Astringent · Polyphenols · Laxative · Cardio-tonic · Anti-oxidants · Anti-inflammatory · Anti-microbial · Diuretics · Nutraceuticals · Cosmeceuticals

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21.1 Introduction

Natural products are the chemicals and compounds that are given to us by nature. The significance of the nature and the natural products are well understood when we come to the ecosystem. For the thousands of years, plants are defending and reigning rank holder which works day and night in their own body for giving us remarkable natural products. The various and different parts of a plant can be a good source for natural compounds. Plants metabolize different organic compounds in their body by complex mechanism comprises physical and chemical episodes of photosynthesis, respiration, degradation. There are two types of metabolism occurs in plant system, like primary and secondary metabolism. Primary metabolism yields primary metabolites which are essential for the growth, development, functioning and the survival of the plant whereas, secondary metabolites play a direct or indirect role in plant's growth and they are not required for a plant to survive. The secondary metabolites of a plant play a key role in plant's defence system, fighting herbivores and pathogens. Also they are found useful in other important functions like giving plant or plant portions a color, maintaining and signaling the primary metabolic pathways etc. (Mazid et al. 2011). Some of the much known important secondary metabolites are terpenes, phenolic metabolites, glycosides and alkaloids.

Tannins and polyphenols are one of the most widely used secondary metabolites obtained from different species of higher altitude plants. It is found from different parts of myrobalan, nutgall, chestnut, rhubarb, bahera, arjuna, Indian goose berry, ashoka bark, black and pale catechu, pterocarpus etc. and they are extracted by maceration. Chemically, they are the mixture of complex organic substances in which polyphenols are present. Tannins are basically phenylpropanoids, condensed to lengthy polymers with molecular weight ranging from 300 to 3000 (Khanbabaee and Van Ree 2001). They are non-nitrogenous and not crystalline in nature, they do possess a bitter taste and they give positive results with Goldbeater's skin test (Nierenstein 1932). Tannins are classified into two types generally, hydrolysable tannins and condensed tannins. Hydrolysable tannins can be hydrolysed easily by enzymes or different acids into gallic acid or ellagic acid, which further process pyrogallol, glucogallin, etc., where condensed tannins do not respond to hydrolysis and being a flavone derivative, they can be related to flavonoid dyes and pigments or phlobatannins or proanthocyanidins (Schofield et al. 2001). It is having astringent property and it helps in precipitation of different proteins, gelatins, glycosides etc. from any solution. The word 'tannin' helps to give a simple knowledge about its property to tan, i.e. ability to convert leather from skin surface (Sieniawska and Baj 2017). Because of this property, tannins and tannin containing drugs can be used in burn treatment. Apart from the astringent property, tannins do possess versatile applications like medicinal uses, industrial uses and biological applications. Tannins are used to treat different diseases and biological conditions like fever, diarrhea, diabetes, eye infections, gall bladder stone, intestinal disorder, constipation etc. (Sieniawska and Baj 2017). Different tannins and tannic acid derivatives obtained from different parts of plants like roots, barks, stems, leaves, galls, fruits, herbs are