Chemistry of Plant Polyphenols in Foods and its Contribution to Human Health

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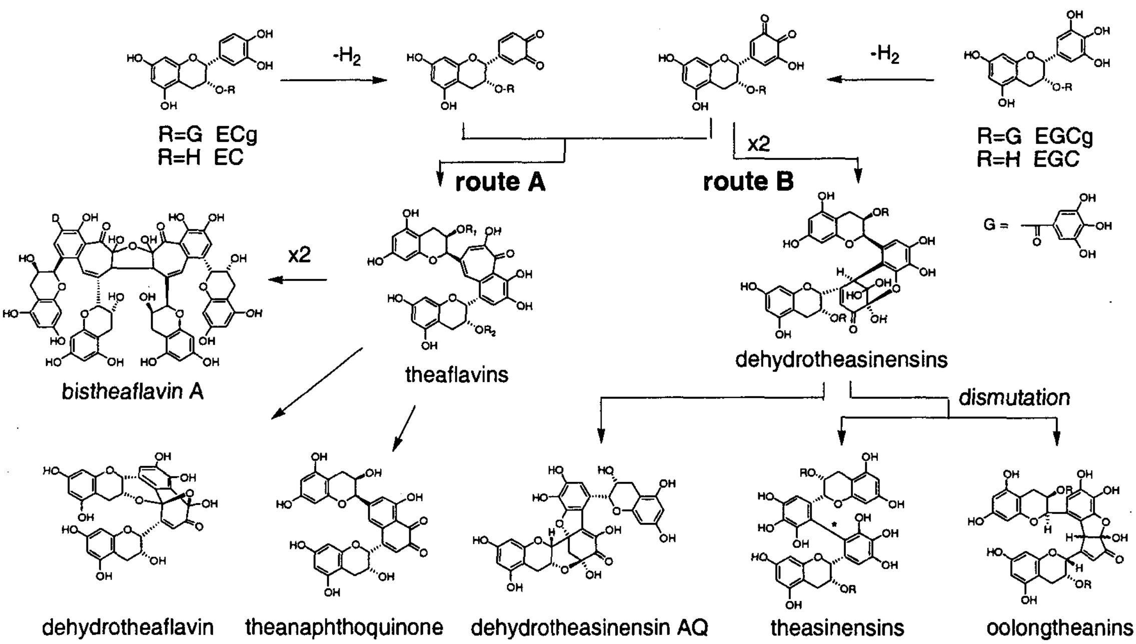
Since sensational reports on "the French paradox" of red wine, scientific publications on polyphenolic compounds have been increasing more and more.. Many of the research suggested the daily intake of polyphenols may reduce the risk of cancer and heart disease. However, chemistry of some important food polyphenols remains still ambiguous. In this presentation, our recent results on catechin oxidation and production of new functional food will be introduced.

1. Chemistry of black tea polyphenols

Black tea and green tea are made from the same tea leaf. In the green tea production, the enzymes are inactivated by heating immediately after harvesting; therefore, composition of the polyphenols is similar to that of fresh leaves and relatively simple. On the other hand, in the manufacture of black tea, four major tea catechins in the fresh leaves are enzymatically oxidized during the fermentation process to produce many oxidation products including characteristic pigments.. Chemical constituents of black tea have not clarified yet, even though black tea accounts for almost 80 % of the world's tea production and is the most important source of dietary polyphenol in the world.

In the course of our chemical studies on plant polyphenols, we are studying the mechanism of production of black tea polyphenols by isolating catechin oxidation products produced by model fermentation experiments. So far, we have found some new interesting oxidation products including some key intermediates of catechin oxidation.[1]

Theaflavin and its galloyl esters are most important black tea pigments, and thier biological activities, such as inhibition of amylase and glucan synthesis, are important as constituents of functional foods. During black tea manufacturing theaflavins are further oxidized. Recently, we have succeeded to elucidate some novel compounds produced from theaflavins for the first time (Route A in Figure).[2,3]

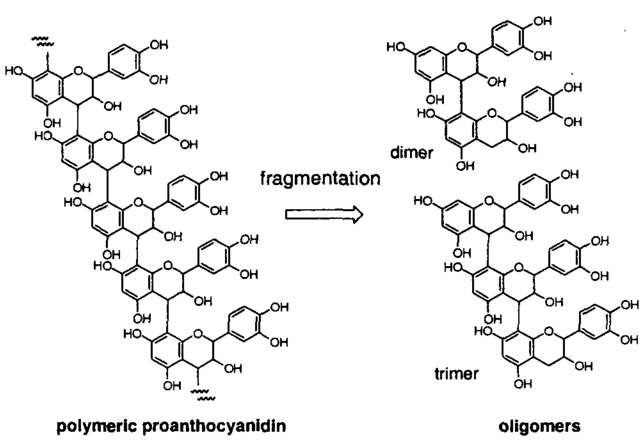


Epigallocatechin and its galloyl ester represent over 70% of tea leaf catechins; therefore, their oxidation products are important in black tea. We disclosed a unique oxidation mechanism of these catechins producing important polyphenols of black and oolong tea, theasinensins and oolongtheanins, *via* unstable intermediates, dehydrotheasinensins (Route B in Figure 2).[4] Dehydrotheasinensin is also important precursor of a novel black tea pigment, dehydrotheasinensin AQ.[5]

In black tea, there are many structurally unknown oxidation products, which comprise almost 70% of total tea polyphenols. Especially, oxidation products with polymeric nature show strong inhibition activity against amylase. We are now continuing the research to clarify the black box of the black tea polyphenols.

2 A new method for production of oligomers from polymeric proanthocyanidins

Recently strong antioxidative activities of oligomeric proanthocyanidins attract a great deal of attention. Proanthocyanidins are oligomers and polymers of C-4 to C-8(or 6) linked catechin units, and found in such as apple, grape, persimmon, red wine, beer. Although polymeric proanthocyanidins usually occupy a large part of the total polyphenols, it is desirable that the



polymers are removed because of their strong astringency and low solubility. Recently we have developed a new and easy method to prepare oligomeric proanthocyanidins by fragmentation of polymers. Since polymeric proanthocyanidins are abundantly present in plant kingdom, this method will provide functional polyphenols at lower cost.

References

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