

that flows upon cutting or whittling the bark and the new wood of various pine tree species (*Pinaceae*). Turpentine contains 'resin acids' and some hydrocarbons, which were initially termed as terpenes. Traditionally, all those natural compounds which are built up from isoprene subunits and, mostly, originating from plants are denoted as terpenes.

All living organisms produce terpenes for certain vital physiological functions and therefore have the potential to produce terpene natural products. Terpenes have a unique antioxidant activity in their interaction with free radicals. Terpenes react with free radicals by means of partitioning themselves into fatty membranes by virtue their long carbon side chain. The most-studied terpene antioxidants are tocotrienols and tocopherols.

Tocotrienols. Tocotrienols are unsaturated analogues of tocopherol, i.e. vitamin E. They are present in the unsaponifiable fraction of vegetable oils; rice bran oil and palm oil are the most noteworthy sources (Eitenmiller 1997). A number of plant foods, ranging from kale and broccoli, to cereal grains and nuts, were also found to have tocotrienols (Piironen et al. 1986).

There are at least four known forms of tocotrienol, with γ -tocotrienol being the foremost potent cholesterol-lowering form (Parker et al. 1993). The cholesterol-lowering nature of tocotrienols was attributed to their ability to inhibit hydroxymethylglutaryl-CoA (HMG-CoA) reductase, known as the rate-limiting enzyme in the cholesterol synthesis pathway (Parker et al. 1993). It has been reported that α -tocopherol aids the inhibitory effect of γ -tocotrienol (Qureshi et al. 1996). Tocotrienols have also been demonstrated to have the vitamin E activity (Tan 1989), antioxidant activity (Serbinova et al. 1993) and antitumor properties (Komiyama et al. 1992). It was theorized that the inhibition of HMG-CoA reductase by tocotrienols also results in suppression of tumour growth (Elson and Qureshi 1995).

Phytoestrogens. Phytoestrogens can compete with steroid hormones for various enzymes and receptors, thereby kindling the production of sex hormone-binding globulin in the liver. Thus, they may alter steroid hormone metabolism and may hinder the growth and proliferation of hormone-dependent cancer cells. Like other phenolic compounds, phytoestrogens possess antioxidant activity, and like oestrogens, they can be capable of influencing the lipoprotein metabolism and enhancing vascular reactivity. Hence the phytoestrogens are proven to have potential protective effects against CVD.

Plant sterols or phytosterols are structurally alike and functionally equivalent to the animal sterol, cholesterol. Phytosterols are triterpenoids occurring in both free and esterified form. Among more than 40 identified phytosterols, β -sitosterol, stigmasterol and campesterol are the most abundant, and are predominantly provided by vegetable oils (Piironen et al. 2000; Hicks and Moreau 2001), which are affluent sources of sterol esters. Ferulic acid esters of phytosterols, commonly known as oryzanol, occur in rice bran oil (Kaneko and Tsuchiya 1954). Nuts, cereals, grains and vegetables are also sources of sterols, albeit of lesser significance.

Stanols or Phytostanols. Plant stanols or phytostanols are the less abundant class of related compounds, which are the saturated forms of phytosterols. Phytostanols are obtained primarily from corn, wheat, rye and rice (Hicks and Moreau 2001). Corn fiber oil is said to be unique, not only because it contains fatty acid and phenolic