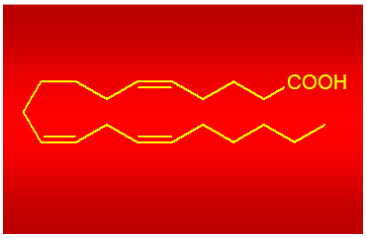
Lipid of the Month: December 2008

Sciadonic acid



Koyama and Toyama in 1957 isolated a new eicosatrienoic acid from the seed oil of *Podocarpus nagi* (1). The double bond location of this acid proved to be unusual, *i.e.* at the $\Delta^{5,6}$, $\Delta^{11,12}$ and $\Delta^{14,15}$ carbons (2). At the same time, 5,11,14-eicosatrienoic acid was also isolated and characterized in tall oil (3). In early literature, the name "podocarpic acid" was used for 5(*Z*),11(*Z*),14(*Z*)-eicosatrienoic acid, but this name is being replaced by "sciadonic acid" reflecting the presence of the acid in seeds of *Sciadopitys verticillata* (umbrella pine) (4). Sciadonic acid occurs primarily in seeds from *Gymnosperms* (5) and is formed from 11(*Z*),14(*Z*)-eicosadienoic acid by action of Δ^5-desaturase activity. Genes coding for Δ^5 desaturases have been cloned and coexpressed with a C_{18} Δ^9-elongase in *Arabidopsis*, and such transgenic plants produce sciadonic acid as well as juniperonic acid (5(*Z*),11(*Z*),14(*Z*),17(*Z*)-eicosatetraenoic acid) (6).

Sciadonic acid can be regarded as a dihydro analog of arachidonic acid lacking the Δ^8 double bond. Mice fed sciadonic acid incorporated significant amounts of the acid in phosphatidylinositol where it partially replaced arachidonic acid (7). Cell culture experiments also demonstrated a preferential incorporation of sciadonic acid in phosphatidylinositol and a concomitant reduction of the level of arachidonic acid (8). Takagi in 1965 reported that feeding sciadonic acid to rats deficient in essential fatty acids resulted in the formation of arachidonic acid, thus suggesting the presence of a desaturase activity introducing a double bond in the Δ^8 position (9). Subsequent studies have failed to support the existence of a desaturase needed for a direct conversion of sciadonic acid into arachidonic acid. However, in a

recently published study, a carbon chain shortening and elongation pathway was shown to permit conversion of sciadonic acid into essential fatty acids (10). Thus, sciadonic acid added to cell cultures was converted into 7(*Z*),10(*Z*)-hexadecadienoic acid by peroxisomal degradation, and subsequent elongation of this 16:2 fatty acid produced 9(*Z*),12(*Z*)-octadecadienoic acid (linoleic acid), precursor of arachidonic acid.

Due to the missing Δ^8 double bond, sciadonic acid cannot be converted to prostaglandins or leukotrienes, however, oxygenation into 15-lipoxygenase products can be expected to proceed normally.

Sciadonic acid (A-2035) and its methyl ester (M-2035) offered by Lipidox are derived from natural sources and purified by open column adsorption chromatography followed by reversed-phase HPLC. Other Δ^5-unsaturated polymethylene-interrupted fatty acids available from Lipidox include taxoleic acid, pinolenic acid, columbinic acid and juniperonic acid.

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