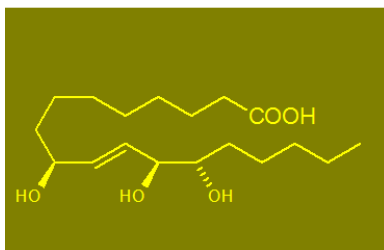


Lipid of the Month: February 2009

Pinellic acid



The first characterization of 9,12,13-trihydroxy-10-octadecenoic acid was published by Graveland in 1970 in a study of lipoxygenase-catalyzed oxygenation of linoleic acid in doughs and flour-water suspensions (1). In addition to hydroperoxides, hydroxides and epoxy alcohols derived from the the added substrate, a fraction consisting of a mixture of 9,12,13- and 9,10,13-trihydroxyoctadecenoic acids was isolated by TLC. Although separation of the regioisomers was not achieved, it could be concluded that the first-mentioned isomer was the dominating one and further deduced that this compound originated in linoleic acid 9-hydroperoxide. Eight stereoisomers (four pairs of enantiomers) of 9,12,13-trihydroxy-10-octadecenoic acid are possible because of the three chiral carbons at C-9, C-12 and C-13. In 1991, two studies demonstrated that naturally occurring 9,12,13-trihydroxy-10-octadecenoic acid has the 9(*S*),12(*S*),13(*S*) configuration (2,3). More recently, 9(*S*),12(*S*),13(*S*)-trihydroxy-10-octadecenoic acid was isolated from tubers of *Pinellia ternata*, and the trivial name *pinellic acid* was given to the compound (4). The stereochemistry was determined by comparison with synthetically prepared stereoisomers (5).

Biosynthesis of pinellic acid in plants can take place by lipoxygenase-catalyzed oxygenation of linoleic acid into linoleic acid 9(*S*)-hydroperoxide which is further converted to the epoxy alcohol 12(*R*),13(*S*)-epoxy-9(*S*)-hydroxy-10(*E*)-octadecenoic acid by action of epoxy alcohol synthase (6) or peroxygenase (7). Pinellic acid is formed from the epoxy alcohol by action of epoxide hydrolase activity, which catalyzes epoxide

opening at C-12 (7). Also linoleic acid 13-hydroperoxide can be converted to 9,12,13-trihydroxyoctadecenoates as shown in a chemical model system (8).

Pinellic acid and other trihydroxyoctadecenoates are produced in plants during wounding and infection by fungal pathogens (2,9-11). Interestingly, such trihydroxy oxylipins inhibit growth of fungi and germination of spores (10,11) and may play a role in plants' defense towards pathogenic fungi. Unrelated to this, current interest in pinellic acid exists for two quite different reasons. First, the compound is present in beer (12,3) and may contribute to the bitter taste of this beverage (13). Consequently, manipulating the levels of pinellic acid can conceivably produce beers having desired taste qualities. Secondly, pinellic acid has been tested with promising results as an oral adjuvant during intranasal inoculation of influenza vaccine (4).

Pinellic acid (O-1802-14) is synthesized by Lipidox by enzymatic reactions and is free of regio- or stereoisomeric contaminants.

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