CO2-extracted northern berries are rich sources of essential fatty acids and natural antioxidants

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CO2-extraction: A gentle method for recovery of lipophilic compounds
Northern berries are famous for their high content of hydrophilic bioactive compounds such as vitamin C, flavonoids, and phenolic acids. Less known is that they are also rich in lipophilic compounds with beneficial effects: fatty acids, carotenoids, tocopherols, tocotrienols and phytosterols. These are enriched in the berries’ seeds and for the most part unavailable for absorption when the whole berry is consumed. Aromtech Ltd (Tornio, Finland) specialises in producing oils from Northern plants by means of supercritical CO2 extraction, which enables gentle recovery of the berry and seed oils.

Supercritical CO2 at high pressure and low temperature has the capacity to penetrate and elute materials efficiently. The low temperature applied, and the absence of oxygen, ensures that no bioactivity is lost. At the end of the extraction process, the CO2 is released from the extract, producing a safe and solvent-free product without thermal stress. There is no need for subsequent steps, which could affect the bioactive compounds. In comparison to the other methods of commercial oil production, organic solvent extraction (hexane) and cold pressing, higher amounts of bioactive compounds have been reported in CO2-extracted oils.

Essential and unique fatty acids of Northern berries
The composition and antioxidant activity of Northern berry oils and berry seed oils extracted by supercritical CO2 at Aromtech Ltd were recently studied by Yang et al. The following oils were analysed: seed oils of bilberries, lingonberries, cranberries, Arctic cranberries, crowberries, cloudbberries, sea buckthorn, raspberries, blackcurrants, redcurrants, snowball berries, European rowanberries, strawberries and cranberries. In sea buckthorn, unlike most other berries, also the soft part of the berries contain a high proportion of oil. The composition and activity of sea buckthorn pulp oil too were analyzed by Yang et al.

Fresh sea buckthorn berries are first dried, seeds and soft parts are separated and the raw material for CO2 extracted SBA24 oil is ready of n-3 vs n-6 fatty acids, with intake of n-6 fatty acids generally being higher than optimal when compared to n-3 intake. The composition of lingonberry seed oil indicates that it is an excellent source of essential fatty acids and provides them in a ratio that would help to bring the balance closer to the recommended n-6:n-3 ratio of about 1:2.

The fatty acid compositions of the currant seed oils are unique in the high content of γ-linolenic (18:3n-6, GLA) and stearidonic (18:4n-3, SDA) acids. Low GLA levels in the body have been associated with malfunction of the enzyme δ-6-desaturase and atopic dermatitis. When compared to red currant, CO2-extracted blackcurrant seed oil is an even better source of GLA and SDA.

The LA and ALA content of sea buckthorn pulp oil is lower than that of the seed oil. The pulp oil, however, is characterized by its roughly 40% palmitoleic acid (16:1n-7), such amounts being rare in other food sources. Consumption of high-palmitoleic-acid-oils has been associated with beneficial effects on circulating total, LDL and HDL cholesterol. Recently, studies suggesting lipokine effects and modulating effects of palmitoleic acid on insulin-resistance and hepatic lipid accumulation have been published.

Natural tocopherols and tocotrienols and their association with antioxidant activity
Of the CO2-extracted oils analysed in the study of Yang et al., the raspberry seed oil stands out in having a high total amount of tocopherols and tocotrienols. The major tocopherol in the raspberry seed oil was γ-tocopherol. In comparison to α-tocopherol, its vitamin E activity is low, but depending on the conditions, it can be more potent as an antioxidant. The superior protective effects against nitrosative stress are particularly well documented.

As a source of α-tocopherol, sea buckthorn pulp oil was the richest of the oils studied by Yang et al. Berries of the Vaccinium genus (lingonberry, cranberry and Arctic cranberry) were the richest sources of tocotrienols, with γ-tocotrienol being the most abundant form. Tocotrienols have been shown to possess antioxidant, neuroprotective and cholesterol-lowering properties that differ from those exhibited by tocopherols.

According to current knowledge, oxidative stress, the imbalance between cells’ pro-oxidant and antioxidant systems contributes to the pathogenesis of several diseases, including cancer and cardiovascular diseases. Yang et al. investigated the antioxidant activity of the CO2-extracted Northern berry seed oils by several distinct methods, to capture the different aspects of antioxidant action. In the peroxyl radical scavenging assay, corresponding to lipophilic...
Intake of blackcurrant seed oil has beneficial effects on skin wellbeing.

Clindically proven beneficial effects

Physiological effects of CO2-extracted oils produced by Aromtech Ltd have been investigated in several clinical trials. Aromtech’s standardised sea buckthorn oil SBA24®, containing sea buckthorn seed and pulp oils, has clinically proven beneficial effects on mucous membranes15, dry eye16, skin17 and factors associated with cardiovascular disease18,19 when taken as an oral supplement. The combination of seed and pulp oils offers a balance of bioactive compounds for good effects on the mucosa and cardiovascular health: the different fatty acids in the sea buckthorn pulp oil2.

In the in vitro DNA oxidation assay, both sea buckthorn seed and pulp oils prevented DNA oxidation in purified DNA and in rat liver homogenate DNA. There were no great differences between the two oils in terms of DNA protection potential20.

References