Optimizing yield and durability of functional components from Broccoli sprouts by extraction with supercritical CO_2

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1 Introduction

In the 18th century Thomas Jefferson imported broccoli (Brassica oleracea) to the USA. Nowadays the vegetable is a valued side dish all over the world. The healthy benefit of broccoli because of its mineral nutrition supply is well known for some time. Currently another functional component of broccoli is solicited: Glucoraphanin appears to possess beside others anticancerogenic properties. From the vegetable to the broccoli sprouts the content of this valuable substance is significantly increasing. By applying supercritical CO_2 for the extraction of the material yield and stability of Glucoraphanin improved enormously.

2 Summary

2.1 Applications and effectiveness

Using conventional selective breeding of broccoli seeds plants were development with specifically high levels of Glucoraphanin. Glucoraphanin (Sulforaphane glucosinolate) is a precursor to the well recognized Phase II enzyme inducer Sulforaphane. Phase II enzymes have the ability to neutralize the chemical toxins, electrophiles and free radicals, that are responsible for the initiation of carcinogenesis. This enhancement to the bodies' immune system is a proactive step one can choose to follow for dietary chemoprotection. [1]

Thus, in addition to its ability to act as a 'blocking' agent against early initiating events, recent evidence points to Sulforaphane as a 'suppressing' agent, helping to delay or reverse growth and/or survival of transformed cells. The precise mechanism(s) that operate during the post initiation phase are not well understood, and only a handful of suppressing agents have been studied in any detail. [1]

Nonetheless, this review considers the evidence that Sulforaphane might represent a multi-faceted chemopreventive agent, with the ability to act during blocking, suppressing and therapeutic stages. [1]

2.2 Extraction

Pre-pressed broccoli sprouts in the shape of collets have been treated with a hammer mill. Extraction of the crushed material with supercritical CO_2 has been performed at 250 - 300 bars and 40 – 60 °C [fig. 1, 2]. Consequently the sprouts have been defatted from 30 – 40 % to < 1 % of fat.

At these conditions Glucosinolates are hardly soluble in CO_2. But by removing the oil the concentration of Glucoraphanin in the extracted material is rising to around 10 %. Additionally rancidity is avoided and the shelf life of the powder is extended due to the absence of fat.

Subsequently the material is capsulated and marketed as nutraceutical worldwide for the applications listed. Also the oil is added to cosmetics effecting e.g. shine of hair and skin and counteracting pigmentary abnormalities.

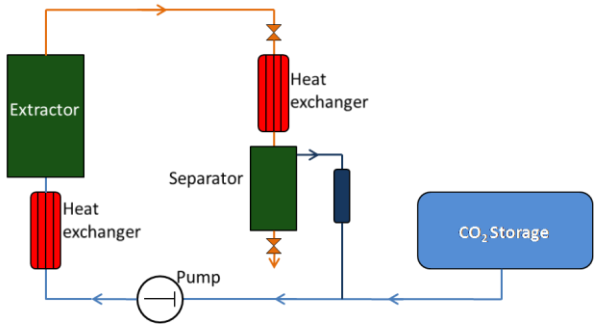

Fig. 1: Flow sheet of a CO_2 extraction plant

Fig. 2: Impression of a plant at NATECO$_2$

3 Conclusion

Caudill Seed Inc. grows and processes the seed in the North America. The intermediate material is shipped to NATECO$_2$ in Germany where the oil from the seed meal is extracted using Super Critical Fluid Extraction with Carbon Dioxide as solvent. This process and the product is considered “All Natural” and the liquid carbon dioxide is food grade and is consider *GRAS (Generally Recognized as Safe)*. No residue remains in the finished product. [1]

The extraction of broccoli sprouts with CO_2 guarantees applicability of both products: Nor in the powder neither in the oil residues of organic solvents are present.

[1] CS Health Homepage; status 26th January 2010; URL: http://www.gluco-r.com/