Development of surfactant-based cloud point extraction of valuable plant compounds

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Plants produce essential compounds such as polyunsaturated oils, pigments, polyphenols, and antioxidants. In order to gain these valuable species, a high energy-consuming pretreatment of the plant biomass and a subsequent extraction with an organic solvent are performed. However, these conventional techniques often lead to disintegration of valuables. Cloud point extraction is an alternative method, which is carried out in an aqueous media containing a nonionic surfactant. The amphiphile molecules of nonionic surfactants form micelles in aqueous solutions. Heating the micellar solution above the cloud point temperature (CPT) induces a split in two phases (a surfactant-rich phase and an aqueous phase). After phase separation of the cloud-point system, hydrophobic solutes (solubilized in the micelles) accumulate in the surfactant-rich phase. Some nonionic surfactants have low CPT and thus can be applied as mild solvents for extraction of natural products (Fig. 1).

Fig. 1: Cloud point extraction of plant products

The aim of this study is to develop a cloud point extraction process of valuable plant compounds out of fresh microalgae cultures and untreated pineapple wastes.

The in situ extraction of microalgae products can be carried out in a heated column with agitation as a continuous countercurrent process in laboratory (Fig. 2) and pilot scale (BIQ Algaehouse).

The competitive yield achieved with different surfactants and feed suspensions illustrate the promising application of this mild extraction technique.

Fig. 2: Continuous extraction of microalgae