HOW TO DEVELOP HEALTH-PROMOTING FOOD SUPPLEMENTS BY USING SINGLE-USE BIOREACTORS

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There is currently considerable interest in alternative and sustainable production methods for healthy foods. The cultivation of plant cell cultures in suitable bioreactors instead of growing whole plants on the field may be a solution. In this way, the cell cultures of interesting plant species can be established independent of the location. Furthermore, secondary metabolism can be specifically controlled during mass propagation of the cells. In other words, the expression of compounds promoting health and wellbeing can be supported, and the formation of substances with adverse health effects can be suppressed. We used this approach to make cacao powder and to produce a ‘cell culture chocolate’ by growing suspension cells from *Theobroma cacao* in a Flexsafe RM 20L bag with a screw cap from a BIOSTAT RM 20/50. The cell line (dark culture) was established from a well-growing and friable callus clone, and has a doubling time of 4 days. It provided up to 40% higher concentrations of the polyphenols epicatechine, procyanidine B1, B2 and C1, and cinnamtannine A2 than cocoa beans from pods grown in Puerto Rico. The alkaloids caffeine and theobromine were absent in the cell culture grown in MS-medium. On day 16, about 300 g biomass (fresh weight) was harvested from the wave-mixed single-use bioreactor operated in feeding mode. Addition of an antifoam agent and pH-regulator was not required. The biomass was freeze-dried, resulting in in vitro cacao powder that was roasted and milled before adding sugar, lecithin and cocoa butter. 3 blocks of dark chocolate (70%) were produced, which provided the experts on the ZHAW`s sensory panel with a unique taste experience. The flavour was intensive and complex, citric and berry flavours being predominant. The results demonstrate the suitability of wave-mixed bioreactors for the development of plant cell-based health-promoting food and food ingredients. Subsequent studies will focus on the influence of power input and shear stress on polyphenol formation, and the development of a scalable low-cost bioreactor.