

ABSTRACT

The study was aimed to develop a process technology for production of ready-to-serve (RTS) beverage using extract of fresh *Spirulina platensis* var *lonor* biomass harvested under optimized growth conditions. Initially, optimization of growth conditions was carried out and the result showed that the maximum biomass yield (1.36 g/L) and protein concentration (59.7 %) was obtained at pH 10, temperature 33.6 °C, incubation period 16 days, inoculum concentration 20 % (v/v) and light intensity 67.5 $\mu\text{mol}/\text{m}^2/\text{s}$. The slight modification in the quantity of few components (2.25 g/L of NaNO_3 , 0.50 g/L of MgSO_4 and 0.02 g/L of CaCl_2) of standard CFTRI medium showed better yield of biomass and protein during optimization. The determined growth curve of *Spirulina platensis* fitted well with Logistic and Boltzmann models with R^2 values 0.98 for both. The net specific growth rate during log phase was 0.382 day^{-1} . The fresh biomass was harvested by centrifugation and further subjected to extraction with two solvent systems namely, hexane: acetone (3:2) and water: ethanol (2:1), for β -carotene and phycocyanin, respectively. The optimization of extraction process variables showed that maximum yield of β -carotene (0.18 mg/g) and phycocyanin (30.72 mg/g) was obtained at solvent volume 20 ml, and extraction time 4 min. The optimum level of sonicator amplitude and temperature was 48 % and 74 %, and 35 °C and 15 °C, for β -carotene and phycocyanin, respectively. The extract obtained was concentrated in a vacuum concentrator to make the final TSS to 28 °Bx. Further, freeze drying was carried out at -55 °C for 4-5 h to remove the excess solvent and moisture from the extract. The extract contains protein 66 % w/w, fat 15 % w/w, phycocyanin 380 mg/g and β -carotene 2.4 mg/g. It also contains zeaxanthin, chlorophyll a, lutein and violaxanthin in trace amounts. The protein profiling studies using SDS-PAGE showed that there was no degradation of phycocyanin and other protein structures of the *Spirulina* during extraction with ultrasound assistance. Various invitro biological assay were performed using the extract and the results are: protein digestibility index was 79.40 %, IC_{50} value of antioxidant activity, α -amylase inhibitory assay, α -glucosidase and anti-cancer activity were 155.80 $\mu\text{g}/\text{ml}$, 58.47 $\mu\text{g}/\text{ml}$, 51.28 $\mu\text{g}/\text{ml}$ and 91.43 $\mu\text{g}/\text{ml}$, respectively. The beverage was prepared by adding 0.1 % w/v of freeze dried extract powder along with other common ingredients viz 0.1 % w/v table salt, 20 % w/v sugar, 0.25 % w/v citric acid, 0.05 % w/v sodium benzoate and 0.02 % v/v of pineapple flavor. Four samples were prepared with varied level of pectin (0 to 1 % w/v). The fuzzy analysis of sensory data of the RTS beverage showed that *Spirulina* beverage with 1 % level of pectin along with common ingredients ranked first and the taste of beverage was considered as 'highly important'. The overall quality of the beverage was maintained good under refrigerated (5 ± 2 °C) storage for 2 months. However, at ambient (30 ± 2 °C) and accelerated (45 ± 2 °C) conditions the overall quality of the product was better upto 30 days.

Key words: *Spirulina platensis*, Fresh biomass, Ultrasound assisted extraction, RTS beverage