

ABSTRACT

The study was aimed to develop a process technology for preparation of probiotic beverage using bitter gourd, carrot and bottle gourd juices under optimized growth conditions. Initially, three probiotic strains were grown in bitter gourd, carrot and bottle gourd in 1:1:1 proportion. *Lactobacillus plantarum* NCDC 414 gave maximum viable cell counts and was selected for fermentation. The maximum polyphenols (156.9 mg/100mL) and total probiotic counts (8.31 Log CFU/mL) was obtained at bitter gourd 29% (v/v), carrot 42% (v/v) and bottle gourd 30% (v/v) of vegetable juice formulation. The fermentation conditions viz. initial pH and temperature were optimized and maximum viable cell count (8.9 Log CFU/mL) and biomass (0.69 g/L) was obtained at pH 6.0 and 31 °C. Growth kinetics of *Lactobacillus plantarum* was studied, and maximum specific growth rate was found to be 0.62 h⁻¹ and 0.53 h⁻¹ in MRS broth and vegetable juice respectively indicating that *L. plantarum* can grow in vegetable juice without external nutrient supplementation. The developed probiotic vegetable juice (PVJ) contained moisture 92.8%, carbohydrates (by difference) 4.5%, total sugars 1.16%, reducing sugars 0.14%, crude fiber 1.16%, dietary fiber 2.86%, fat 0.37%, protein 0.86%, ash 0.64%, Ca 7.6 mg/100g, Mg 7.1 mg/100g, K 11.6 mg/100g, Fe 0.45 mg/100g. The *L. plantarum* in PVJ was found to be tolerant to acid (pH 2.0), bile (0.3 %) and pancreatic enzyme. The PVJ was analyzed for cucurbitacin, a toxic constituent present in bottle gourd and was found in safe limits (26.84 ppm). *In vitro* α -amylase and α -glucosidase inhibitory assay of vegetable juice medium showed anti diabetic activity with IC₅₀ value of 43.39 ± 1.85 and 39.79 ± 1.57 µg/mL, respectively. The fuzzy analysis of sensory data of four ready-to-serve (RTS) beverages showed that probiotic beverage with 0.25% guar gum ranked first during sensory evaluation. Rapid method was developed for the determination of polyphenols in PVJ using chemometrics coupled with PLS regression analysis in FT-NIR. Storage studies at 4 °C in glass bottles revealed that: pH, total polyphenols decreased by 0.54 units and 11.7%; acidity and color change (ΔE) increased by 56.5% and 4.59 units, respectively. Phase separation increased until 35% after 28 days of storage and stabilized thereafter; viable cell counts decreased after 28 days of storage. The shelf life of the beverage was found to be 6 weeks at 4 °C.

Key words: Non dairy probiotic beverage, *Lactobacillus plantarum*, Growth kinetics, Probiotic vegetable beverage