Principle component analysis of equilibrium headspace concentration of beverage emulsion as function of main emulsion components.

ABSTRACT

A three-factor central composite design (CCD) was used to study the effect of two hydrocolloids namely Arabic gum (7-13% w/w), xanthan gum (0.1-0.3% w/w) as well as orange oil (6-10% w/w) on the equilibrium headspace concentration of target flavor compounds released from the diluted beverage emulsion. Headspace solid phase microextraction (HS-SPME) coupled to gas chromatography (GC) equipped with Time-of-Flight Mass Spectrometer (TOFMS) was employed for the equilibrium headspace analysis of orange beverage emulsion. In qualitative analysis of cold pressed orange oil, 24 volatile flavor compounds were detected by using HS-SPME-GC-TOFMS. Among these volatile flavor compounds, 13 volatile compounds from different chemical classes namely monoterpene hydrocarbons (i.e. α-pinene, β-pinene, 3-carene, myrcene, limonene and γ-terpinene), esters (i.e. ethyl acetate and ethyl butyrate), alcohol (i.e. linalool) and aldehyde compounds (i.e. octanal, decanal, neral and geranial) were composed of >98% of total volatile flavor compounds. For equilibrium headspace analysis, the peak area of target volatile compounds was investigated as response variables. The significant ($p < 0.05$) second-order regression models with relatively high R2 (≥ 0.785) were fitted for explaining the equilibrium headspace concentration. Orange beverage emulsion containing 7% (w/w) Arabic gum, 0.24% (w/w) xanthan gum and 10% (w/w) orange oil was estimated to provide the highest concentration of equilibrium volatile headspace. Closeness between experimental and predicted equilibrium headspace concentrations indicated the adequacy of the response surface models fitted to the experimental data. Principle component analysis discriminated the beverage emulsions containing the same orange oil content but different contents of emulsifier fraction in different groups, thus indicating significant ($p < 0.05$) effect of emulsifier fraction on equilibrium headspace concentration of diluted beverage emulsion.

Keyword: Central composite design; Hydrocolloids; Arabic gum; Xanthan gum; Orange oil; Equilibrium volatile headspace; Flavor compounds.