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Original Research Article

Response surface methodology based on central composite design for optimizing temperature-controlled ionic liquid-based microextraction for the determination of histamine residual in canned fish products

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ABSTRACT

A rapid and simple analytical procedure for the determination of histamine in canned fish products using temperature-controlled ionic liquid-based microextraction (TC-IL-ME) mated to chemometric tool and coupled to spectrophotometer was developed. The variables of interest in the TC-IL-ME method, such as volume of disperser solvent, pH, tartarazine (as ligand) amount, extraction temperature as well as ionic liquid amount were optimized by using a response surface methodology (RSM) based on central composite design (CCD). The ionic liquid, 1-hexyl-3-methylimidazolium tetrafluoroborate [Hmim] [BF₄] was used as an extraction solvent, while acetone was used as a disperser solvent. The optimum TC-IL-ME conditions were found as pH 6.0 of sample solution, 60.7 $\mu\text{mol L}^{-1}$ of tartarazine amount, 765 μL of acetone volume, 0.5 mg of [Hmim] [BF₄] amount and 36 °C of extraction temperature. Interactions between tartarazine and histamine were also investigated using computational chemistry approach. Under the selected conditions, the calibration curve was linear in the range of 2–400 ng mL^{-1} . The repeatability and reproducibility (RSD%) were ranged between 2.5–3.7 % and 2.8–4.1 %, respectively and limit of detection (LOD) was calculated to be 0.65 ng mL^{-1} . The accuracy of the recommended method was confirmed by the analysis of reference material (TET040RM-Histamine in canned fish), the spike test showed recoveries between 92.4 % and 104.9 %. Finally, the recommended method was successfully applied to canned fish products, the concentration of histamine ranged from 62.8–287.5 $\mu\text{g g}^{-1}$.