

Food forensics on gelatine source via ultra-high-performance liquid chromatography diode-array detector and principal component analysis

ABSTRACT

This study provided a step-by-step procedure to investigate the distribution of 17 amino acids (AAs) in 50 fish, 50 bovine and 54 porcine gelatines using Ultra-High-Performance Liquid Chromatography Diode-Array Detector (UHPLC–DAD) with the incorporation of principal component analysis (PCA). Dataset pre-processing step, including outlier removal, analysis of variance (ANOVA), dataset adequacy test, dataset transformation and correlation test was performed before the PCA. The method rendered linearity range of 37.5–1000 pmol/μL and accuracy of 85–111% recovery. The bovine and porcine gelatines showed a similar ranking while the L-Alanine (Ala), L-Arginine (Arg) and L-Glutamic acid (Glu) concentrations had differed the fish gelatine from the bovine and porcine gelatines. The PCA, which explained 77.013% cumulative variability at eigenvalue of 5.436, showed AAs with strong FL in PC1 had polar and nonpolar side chains while AAs with strong FL in PC2 had polar side chain. The AAs with moderate and weak FL in PC1 had a nonpolar side chain. The AAs with strong FL of in PC1 were also the same AAs with 7, 6 and 5 strong CMs as determined in the correlation test. The second PCA showed that the L-Serine (Ser), Arg, Glycine (Gly), L-Threonine (Thr), L-Methionine (Met), L-Histidine (His) and L-Hydroxyproline (Hyp) were significant in fish gelatine; Hyp, Met, Thr, Ser, His, Gly, and Arg in bovine gelatine; and L-Proline (Pro), L-Tyrosine (Tyr), L-Valine (Val), L-Leucine (Leu), and L-Phenylalanine (Phe) in porcine gelatine. The 100% fish, bovine and porcine gelatines accommodated grouping 1, 2 and 3, respectively, which proved that AAs with strong FL (Hyp, His, Ser, Arg, Gly, Thr, Pro, Tyr, Met, Val, Leu and Phe) were the significant AAs and becomes the biomarkers to identify the gelatine source. From this study, the PCA was a useful tool to analyse a multivariate dataset that could provide an in-depth understanding of AA distributions as compared to ANOVA and correlation test.

Keyword: Amino acids; Gelatine; UHPLC-DAD; Principal component analysis; Food forensics