



POSTER

PRELIMINARY STUDY ON THE CORRELATION BETWEEN ELECTRONIC NOSE SENSOR RESPONSES AND PROTEIN DEGRADATION AND LIPID OXIDATION INDICES IN FISH PRODUCTS

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Aim. This preliminary study assessed the response of electronic nose (E-nose) sensors to protein and lipid degradation in fish products by comparing compliant within shelf life (CTR) and expired (SC) samples. The aim was to determine whether the detected volatile profiles mirrored the biochemical changes associated with product deterioration and could be used as a rapid, non-destructive tool to support official food inspection and quality assessment.

Methods. Different fish products, including smoked salmon (CTR and SC), tuna in glass and metal packaging (CTR and SC), sardines in seed oil (CTR and SC), anchovies with chili pepper (CTR and SC) and anchovies in sunflower oil (CTR and SC), were analysed using an electronic nose (PEN 3.5) equipped with metal oxide semiconductor (MOS) sensors. The five most informative sensors (S2, S6, S7, S8 and S9) were selected for Principal Component Analysis (PCA). Total volatile basic nitrogen (TVB-N), trimethylamine (TMA) and thiobarbituric acid reactive substances (TBARS), were also determined to assess the degree of quality deterioration. Differences in these spoilage indicators between CTR and SC samples within each product category were evaluated by one-way analysis of variance (ANOVA; $p < 0.05$ and $p < 0.01$). Finally, the relationships between the responses of the selected sensors and the spoilage indicators were investigated using Spearman's rank correlation analysis.

Results. PCA explained 99.03% of the total variance (PC1: 92.37% and PC2: 6.66%) and clearly discriminated CTR from SC samples. However, the degree of separation depended on the type of fish product, being most pronounced for smoked salmon and less pronounced for canned tuna

and anchovies in sunflower oil. This discrimination was supported by the significantly higher ($p < 0.01$) TVB-N, TMA, and TBARS values observed in the SC samples, that confirming the progressive protein and lipid degradation occurring during spoilage. Correlation analysis further revealed significant positive relationships ($p < 0.05$) between the E-nose sensors and TMA, particularly for sensors S2 ($\rho = 0.604$), S7 ($\rho = 0.661$), and S9 ($\rho = 0.625$), whereas weaker ($p > 0.05$) associations were found with TVB-N and TBARS, suggesting that the sensor response was primarily associated with volatile compounds related to microbial degradation.

Conclusions. This preliminary study demonstrates that the E-nose technology could be a valuable tool for detecting volatile changes associated with fish spoilage showing potential to discriminate compliant within shelf life from expired products, even in food categories where spoilage markers typically evolve slowly. By capturing variations in the headspace volatile profile that reflect underlying biochemical processes, the E-nose shows potential as a rapid, non-destructive and user friendly screening method, suitable for on-site measurements and high-throughput testing. Nevertheless, further validation on a wider range of fish species, product typologies (fresh, frozen-thawed, processed) and storage conditions, as well as under real industrial and retail settings, is needed before routine application in quality assessment and official food control. Such studies should also include standardisation of measurement protocols, assessment of robustness and repeatability, and integration with conventional chemical and microbiological analyses to establish reliable threshold values and decision criteria.