Monitoring the lipid oxidation of oil during frying using algorithm-assisted surface enhanced Raman spectroscopy

AUTHORS

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PURPOSE OF THE ABSTRACT

Deep frying of food is a common practice that leads to the formation of lipid oxidation products. Titration is a widely used technique for determining the peroxide value (POV) of oil. However, this method uses a lot of reagents, many of which are poisonous and smelly, polluting the environment. Oil quality control requires the development of novel, rapid, and accurate detection techniques. In this study, the potential of surface enhanced Raman spectroscopy (SERS) in conjunction with chemometrics has been explored for determining the POV of oil. Au@Ag core-shell nanoparticles with surface plasmon resonance at 532 cm -1 have been synthesized as a substrate for SERS. Principal component analysis was used to distinguish the oil belonging to different frying cycles. Rapid spectrum characterization for estimating POV in oil oxidation was achieved using the artificial neural network-Levenberg-Marquardt fitting model along with principal component analysis. The mean square error and correlation coefficient for the training and test sets of oil samples were 0.92, 0.91, and 3.46, 3.80 respectively. The developed algorithm-assisted SERS system enabled the sleek and rapid analysis of POV in oil oxidation.
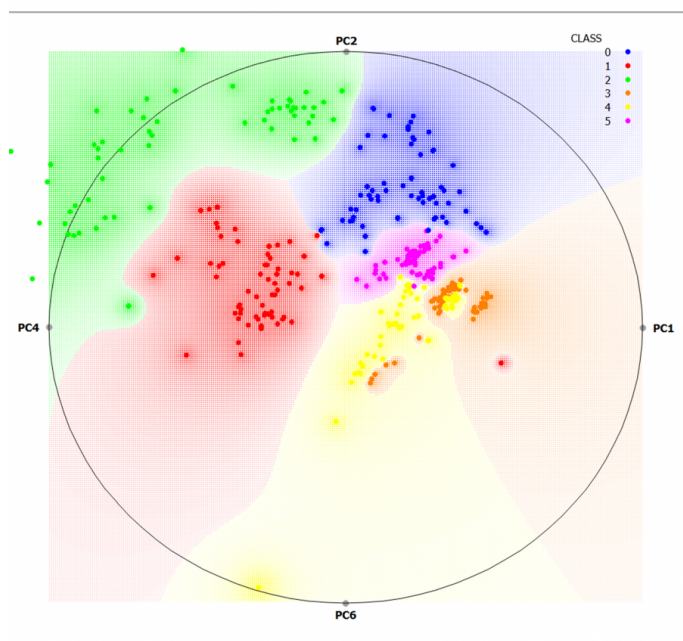
FIGURES

FIGURE 1
PCA scatter plot
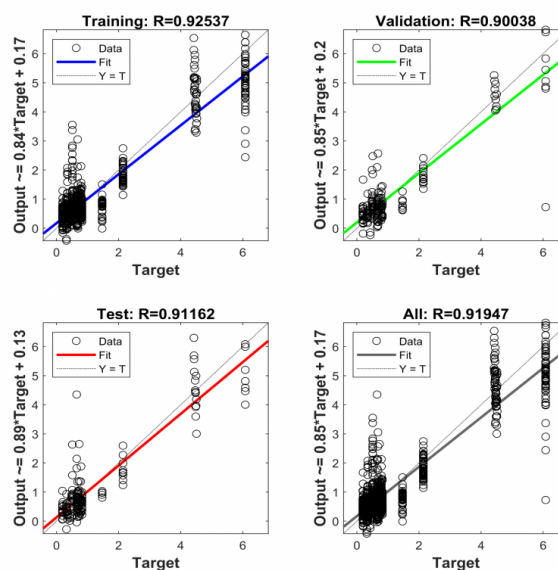Class 0-5 denotes oil with frying cycle 0-5

FIGURE 2
Regression Analysis
Open circles represent the outputs plotted against the target. The best linear fit is indicated by a dashed line. The ideal fit is indicated by the solid line (output equal to targets).

KEYWORDS
Peroxide Value | Principal component analysis | chemometrics | Raman spectroscopy

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