UNIVERSITI TEKNOLOGI MARA

SYSTEMATIC CLASSIFICATION OF PINEAPPLE VARIETIES BY CHEMOMETRIC APPROACHES USING SENSORY ANALYSIS, VOLATILE COMPOUNDS AND PHENOLIC COMPOSITIONS

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ABSTRACT

Classification and quality control of fruits in Malaysia is based on the morphological traits manual done by the agricultural officer. Thus, this approach could be biased and inconsistent due to solely dependent on human perception and judgment. The main objective of this study was to systematically classify four pineapple varieties (Josephine, MD2, Morris, and Sarawak) using sensory attributes, phenolic and volatile organic compounds (VOCs). The aroma of pineapple is made up of a wide range of volatile and non-volatile compounds depending on the varieties can be valuable factors in classifying the fruits. Initially, phytochemical assays including antioxidant activity, total phenolic content (TPC), and total flavonoid content (TFC) were carried out to assess its ability in differentiating pineapple varieties. Chromatographic profiles of VOCs were obtained by extracting pineapples of different varieties using solid phase microextraction and gas chromatography mass spectrometry (SPME-GCMS). Optimisation of SPME operating parameters was conducted using three-factor, Box–Behnken response surface experimental design to evaluate the interactive effects of temperature, extraction time and salting effect on the amount of selected VOCs. Based on the maximum amount of these VOCs, the optimum operating extraction conditions for SPME were set up at a temperature of 30 °C, a time of 29 min, and salt addition of 1g. Phenolic compounds from pineapple pulp were extracted using pressurised liquid extraction prior to separation using a 2-dimensional-liquid chromatography–diode array detector (2D-LC-DAD). Sensory profiles conducted using quantitative descriptive analysis (QDA) revealed the fruity aroma of pineapple was insignificant to differentiate between the pineapple varieties with a scale of 4.13±2.07, 5.33±2.58, 3.87±2.07, and 3.00±0.00 for Morris, Josephine, MD2, and Sarawak, respectively. It can be concluded sensory analysis alone could be biased and unreliable in discriminating pineapple varieties. By combining chemometric analysis using the sensory data, volatile and phenolic compounds more significant finding was observed. Principal component analysis (PCA) supported the hierarchical cluster analysis (HCA) whereby four distinct groups were obtained representing different varieties of pineapple. Partial least square discriminant analysis (PLS-DA) was applied to correlate between phenolic, volatile, and sensory attributes which allowed clear identification of potential marker compounds responsible for varietal discrimination of each pineapple variety. Artificial neural network (ANN) models were developed using phenolic (P-ANN1) and volatile (P-ANN2) data sets as input variables. Results showed the classification model P-ANN2 using input VOCs gave better discriminating between pineapple varieties with correct classifications rates of 97.1% in the prediction model, 92.3% in the testing phase, and 92.0% for the validation phase. A comprehensive and systematic classification of the four pineapple varieties was established by combining the 13 sensory attributes, 10 selected phenolic compounds, and 35 VOCs.

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