Rapid determination of trace substance, 2-acetyl-1-pyrroline content in Hom Mali rice using near infrared spectroscopy

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The analysis of 2-acetyl-1-pyrroline (2AP) content in Hom Mali rice by conventional method is time consuming, an experienced technician is needed and it is costly, therefore a reliable and rapid method for determining 2AP content in aromatic rice is required. The purpose of this study was to assess if the 2AP content in Hom Mali rice could be determined using near infrared (NIR) spectroscopy. A total of 205 ground samples with 2AP in the range 0.52–3.32 ppm were scanned by a Fourier-transform near infrared (FT-NIR) spectrometer in reflectance mode over the region 1100–2500 nm at room temperature (25–27°C). 2AP content was analysed by headspace-gas chromatography and used as the reference method. A model derived from this study was developed and the coefficient of determination ($R^2$), root mean square error of prediction (RMSEP) and bias of the calibration equation were 0.79, 0.27 and 0.01 ppm, respectively. The calibration equation developed in this study could rapidly predict 2AP content and there was no significant difference between NIR-predicted values and actual values at a confidence interval of 95%. The calibration was based on ranges at 1409 nm and 1895 nm wavelengths which infer that the 2AP is linked to the lipid content of the samples. Therefore, it can be concluded that NIR spectroscopy can be used for the evaluation of 2AP content at the ppm level in Hom Mali rice.

Keywords: 2-acetyl-1-pyrroline, aromatic rice, Khao Dawk Mali 105, RD15, Fourier-transform near infrared spectroscopy, Hom Mali rice

Introduction

Rice is the most important crop in Thailand; not only for local consumption, but also for export to several countries. In the world market, Thai Hom Mali rice has been widely accepted for its high and unique quality. There are two rice varieties, Khao Dawk Mali 105 (KDML 105) and RD15, that are accepted as Hom Mali rice. Its grains contain a natural fragrant aroma depending on its age, and when cooked, retain a soft texture. These specific characteristics, especially aroma which plays an important role in consumer acceptance stimulates a premium price compared to other varieties. The aroma of fragrant rice is derived mainly from 2-acetyl-1-pyrroline (2AP) which was originally identified as the key aroma compound of cooked rice and contributing to a popcorn-like aroma in several Asian aromatic rice varieties. Orientals normally describe the aroma of aromatic rice as pandan-like. The 2AP compound in fresh and aged KDML 105 rice, non-aromatic rice and pandan