

Signal Processing Strategies in FT-NIR and FTIR Spectra of Palm Oils

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Abstract- In the palm oil industry, iodine value (IV) has become an important parameter in quality control that measures the degree of unsaturation of the oils. However, it is difficult to obtain the IV chemically. In other hand, the use of instrumental analysis in IV determination accurately needs suitable data pre-processing. In this study, we proposed the strategy for pre-processing the FT-NIR and FTIR spectra data in analyzing the IV of non-fried and fried palm oils. The utility and effectiveness of four data pre-processing which are column standardization, mean centre and combination of row scaling with column standardization and mean centre were applied. The effect of data splitting methods which are duplex and kenstone was also investigated in the Partial Least Squares (PLS) regression model of palm oils. From the result, the use of different data pre-processing provides different quality of prediction model. Either the application of the row scaling and column scaling individually or combination of both methods may improve the quality of the model. It is concluded that the data pre-processing is context dependent which is depend on the nature of the dataset and there can be no single method for general use.

Index Terms—FT-NIR, FTIR, row scaling, standardisation, mean centre, palm oils.

I. INTRODUCTION

IV is used to measure the unsaturation in oils and fats and expresses the amount of absorbed iodine [1]. Based on previous research, IV usually determined by traditional methods which uses highly toxic, carcinogenic and environmentally unfriendly chemicals [2]. The application of instrumentation techniques coupled with chemometrics methods has been conducted as an alternative to the limitation of the traditional methods. FT-NIR and FTIR spectroscopy had appeared as powerful and alternative technique prior to the wet and chromatographic methods because little sample preparation is needed, rapid analysis and the use of hazardous solvents is minimized [3]. FT-NIR that use longer path-lengths enable the deep penetration of NIR lights to the samples, thus better representations of chemical properties occurred rendered FT-NIR as a powerful technique. Meanwhile, the Attenuated Total Reflectance (ATR) that equipped with FTIR greatly simplifies the sample preparation.

Partial Least Squares (PLS) of chemometrics method has been widely used in analysis involve multiple variables by calibration of IR spectra. In PLS modeling, the most appropriate data pre-processing should be carefully selected in relation to the successive modelling stage. Several publications have