PREDICTION OF SUGAR CONTENT OF COCONUT SAMPLES USING NEAR INFRARED SPECTROSCOPY COUPLED TO MULTIVARIATE DATA ANALYSIS

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INTRODUCTION

It has already known that the levels of carbohydrates present in coconut biomasses are favorable to its use in the bio-ethanol production. It is important to highlight that our interest for this biomass was not in the fruits (food), but only in the waste material (fibers and husks), allowing the reduction of residues disposal and pollution, and increasing the value to coconut cultivation.

OBJECTIVES

This study investigates the potential of compositional analysis of coconut residues by NIR and chemometrics, with respect to sugar content for their future use in obtaining value-added chemical inputs.

EXPERIMENTAL

30 different botanical fractions (fibers and husks) from coconut residues, collected in the period 2011-2012 in the North and Northeast regions of Brazil, were analyzed. The mean spectrum of each botanical fraction and for different size fractions from coconut components are shown in Figure 1.

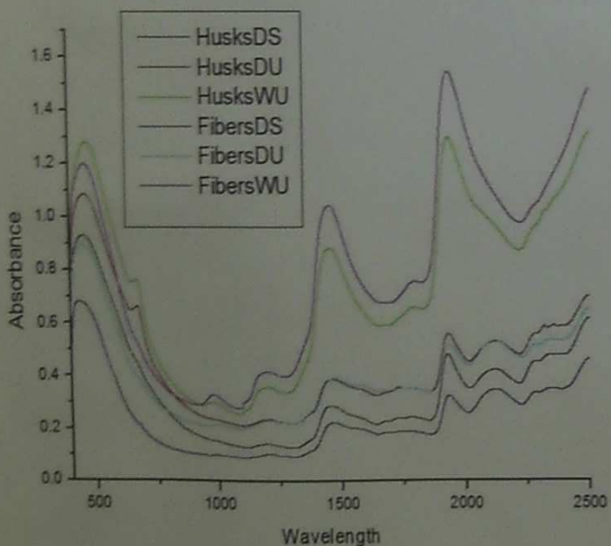

Figure 1. Spectra of different botanical fractions of different sizes from coconut.

DS: 180 < x < 850 µm particle size fraction.

DU:air-dried and unground samples

WU: wet and unground samples.

RESULTS AND DISCUSSION

Statistical results for the calibration models are in Table 1.

Table 1. Results of PLS calibration models and prediction (LV: latent variable RMSE: root mean square error)

Data set	DS	DU	WU
MANNOSE (SNV+1D)	1100-2500	1100-2500	1100-2500
R^2CAL, R^2VAL	0.70; 0.60	-	0.57; 0.51
RMSEP, RMSEC	0.08; 0.15	-	0.07; 0.13
LV, OUTLIER	6; 3	-	2; 4
GLUCOSE (SNV + 1D)	1100-2500	1100-2500	1100-2500
R^2CAL, R^2VAL	0.94; 0.92	0.95; 0.85	0.92; 0.86
RMSEP, RMSEC	0.89; 1.08	1.36; 0.8	1.85; 1.04
LV, OUTLIER	6; 0	6; 3	5; 2
XYLOSE (2D)	1100-2500	1100-2500	1100-2500
R^2CAL, R^2VAL	0.89; 0.82	0.90; 0.85	0.87; 0.83
RMSEP, RMSEC	1.04; 1.15	1.07; 1.14	1.16; 1.11
LV, OUTLIER	2; 0	3; 0	4; 2
GALACTOSE (2D)	1100-2500	1100-2500	1100-2500
R^2CAL, R^2VAL	0.91; 0.85	0.73; 0.70	0.95; 0.80
RMSEP, RMSEC	0.14; 0.06	0.15; 0.13	0.12; 0.06
LV, OUTLIER	5; 2	4; 4	6; 4
ARABINOSE (2D)	1100-2500	1100-2500	1100-2500
R^2CAL, R^2VAL	0.90 0.83	0.85; 0.76	0.92; 0.71
RMSEP, RMSEC	1.17; 0.15	0.16; 0.19	0.31; 0.13
LV, OUTLIER	3; 3	4; 8	1; 1
RHAMNOSE (SNV+1D)	1100-2500	1100-2500	1100-2500
R^2CAL, R^2VAL	0.80; 0.70	0.82; 0.73	0.63; 0.60
RMSEP, RMSEC	0.39; 0.012	0.034; 0.010	0.018;0.018
LV, OUTLIER	7; 4	5; 4	4; 4
TOTAL SUGARS (SNV+1D)	1100-2500	1100-2500	1100-2500
R^2CAL, R^2VAL	0.95; 0.94	0.94; 0.93	0.85; 0.83
RMSEP, RMSEC	2.05; 1.41	2.01; 1.63	3.81; 2.30
LV, OUTLIER	7; 0	4; 2	4; 3

CONCLUSIONS

In conclusion, NIR spectroscopy has been proved to be useful for future chemical prediction of coconut wastes. With the exception of mannose content for the three size particle and rhamnose for WU fraction, which was predicted poorly ($R^2 < 0.7$), all the chemical properties exhibited $R^2 > 0.7$. The methods were validated, as shown by the satisfactory results obtained.

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