

Contribution of Near Infrared Spectroscopy to identify CITES Appendix II woods: case of four *Dalbergia* species from Madagascar

CONTEXT

Precious wood of Madagascar, which includes rosewood, palissander and ebony tree species are seriously threatened because of the intensification of their illegal logging and trade.



This frightening situation is worsened by the difficulty of species identification.

Need a tool to help control agent to identify precious wood.

OBJECTIVE

This study aims to investigate the potentiality of using a Micro-nir spectrometer to discriminate Malagasy *Dalbergia* and *Diospyros* species.



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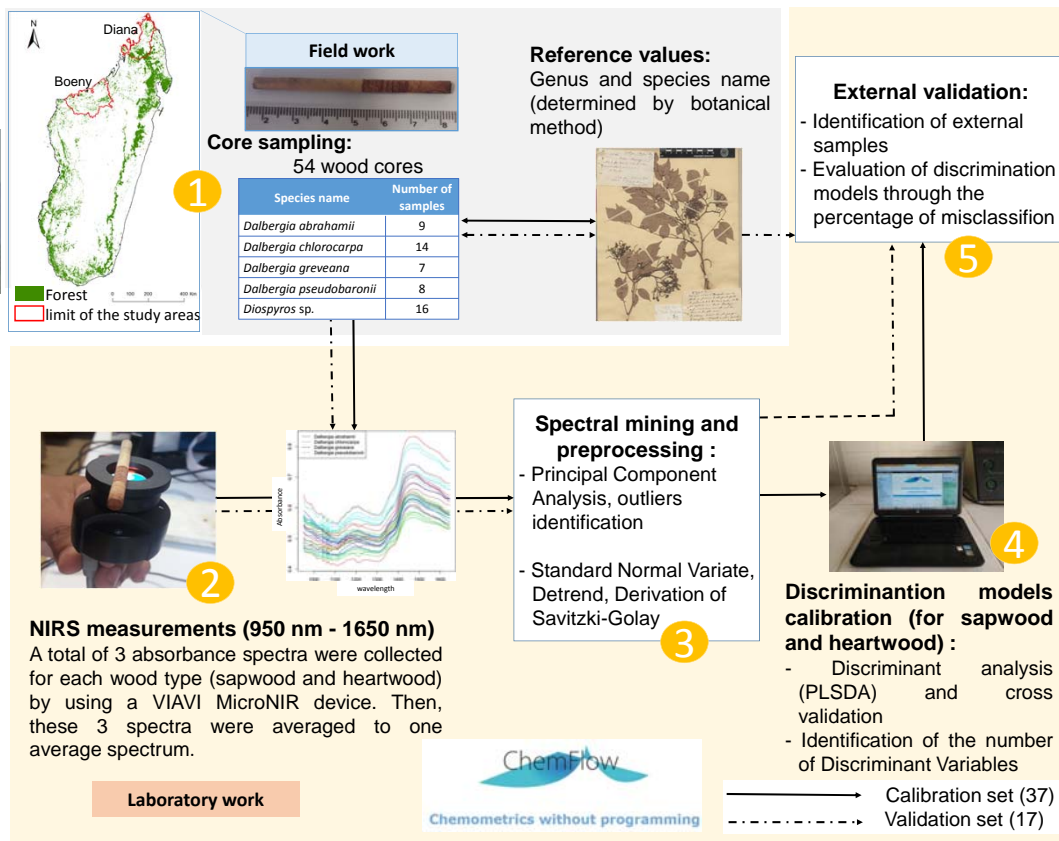
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MATERIALS AND METHODS



RESULTS

Table 1 : Percentage of misclassified samples of the external validation step

Discrimination of the 2 genera		
Preprocessing	Sapwood	Heartwood
Derivation	12.9 %	7.6 %
Discrimination of the 4 <i>Dalbergia</i> species		
Preprocessing	Aubier	Duramen
Derivation	36.3 %	20 %

Table 2 : Confusion matrix of the best discrimination models during the external validation step

Discrimination model of the two genera (1st derivate, 9 VDs)

		Reference values	
		<i>Dalbergia</i>	<i>Diospyros</i>
Predicted values	<i>Dalbergia</i>	23	2
	<i>Diospyros</i>		1

Discrimination of the four *Dalbergia* species (1st derivate, 7 VDs)

		Reference values			
		<i>D. abrahamii</i>	<i>D. chlorocarpa</i>	<i>D. greveana</i>	<i>D. pseudobaronii</i>
Predicted values	<i>D. abrahamii</i>	3			1
	<i>D. chlorocarpa</i>		3	1	
	<i>D. greveana</i>			1	
	<i>D. pseudobaronii</i>				1

First Derivates preprocessing of the spectral data improves the performance of the discrimination models.

The discrimination of the two genera (*Dalbergia* and *Diospyros*, Table 1, 2) gives better results. Discrimination models calibrated from the heartwood are more efficient than those which are calibrated with the sapwood (Table 1). For the best models, misclassification rate for the sapwood and heartwood models of the external validation step are respectively 12.9 % and 7.6% for the two genera, and 36.3 % and 20% for the four *Dalbergia* species (Table 1). Discrimination models of the four *Dalbergia* species show an encouraging result with an error rate of 20%, even if the number of samples is low.

CONCLUSION AND PERSPECTIVES

This first use of the Near InfraRed tool to discriminate malagasy precious woods brings an innovation in the field of wood science. Results highlight the potential of the portable MicroNir in the identification of Malagasy woods. Spectra measured on the heartwood allow to separate more efficiently the species, probably because of the extractives (Jebrane, 2009) which influence the absorbances. However, additional works should be carried out in order to use this tool effectively in the identification of Malagasy precious wood. Number of test samples per species should be increased (20 to 30 samples, Agelet and Hurburgh, 2010), and all existing *Dalbergia* and *Diospyros* species in Madagascar should be considered to meet CITES requirement.

References

- Agelet, L.E. & Hurburgh, C.R. (2010), "A tutorial on near infrared spectroscopy and its calibration." *Critical Reviews in Analytical Chemistry*, **40**:246-260. doi:10.1080/10408347.2010.515468
- Jebrane, M., (2009), *Fonctionnalisation chimique du bois par transestérification des esters d'enol*. Thèse de Doctorat - spécialité Chimie Organique - Université Bordeaux 1. 22:53-78.

Acknowledgement:

