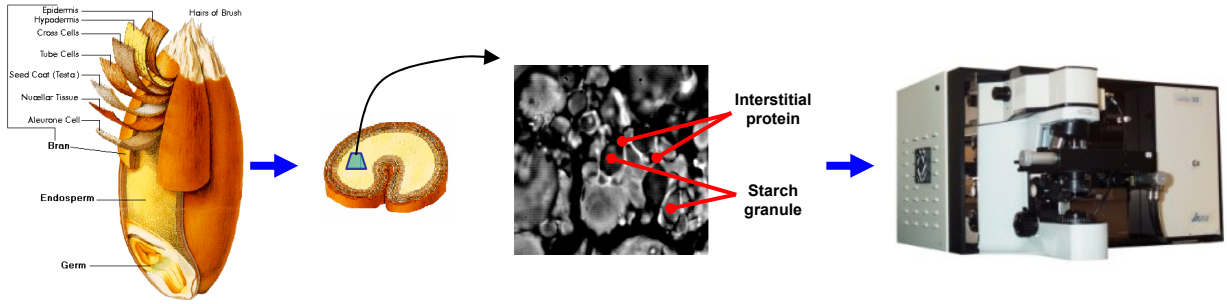
HORIBA JOBIN YVON Raman Application Note

Raman Mapping of Wheat Grain Kernels

Introduction

The essential property of wheat varieties is the hardness of the grain. The milling value depends on this property and corresponds to the ease with which the grain kernel can be fragmented. A better understanding of the molecular basis of the grain cohesion can lead to optimization of the milling by selecting more interesting wheat varieties or by applying specific chemical treatment on commonly raised wheat.

This study illustrates spectroscopic characterisation of the structure of the wheat grain. Besides its high spatial resolution (1 µm), Raman micro spectroscopy enables the identification of specific components of the kernel using marker bands. Non destructive Raman micro spectroscopy also enables *in situ* characterisation of the wheat protein secondary structure.



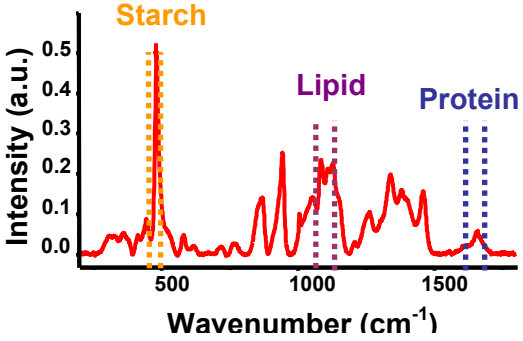
Experimental

Experiments were made on *Triticum aestivum* wheat grains, which were supplied by INRA Montpellier and by Champagne Céréales.

Raman analysis was carried out with a LabRAM Raman microscope, using a 633 nm HeNe laser (typically 8 mW on sample). Raman images consisting of 15x11 point analyses were recorded on 50 µm thick solid sections, obtained with a cryomicrotome.

Spectral Characterisation

Raman analysis of a starch granule within the wheat grain kernel shows distinct spectral features arising from the starch, lipid and protein species present.
The presence of these clear marker bands allows Raman mapping to be used to identify the distribution of these components.



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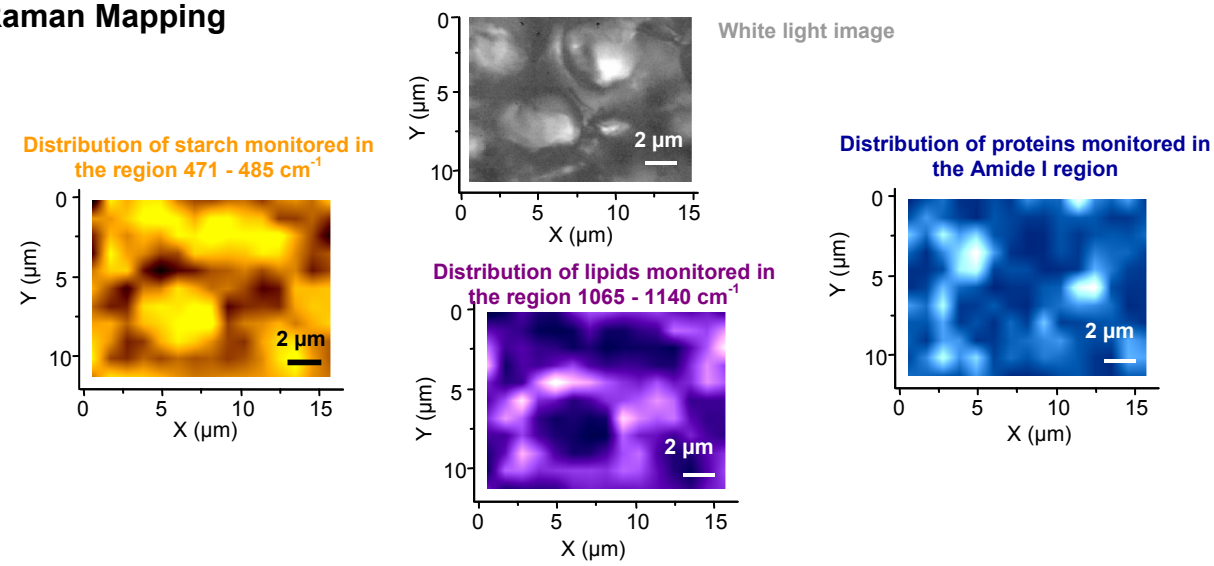
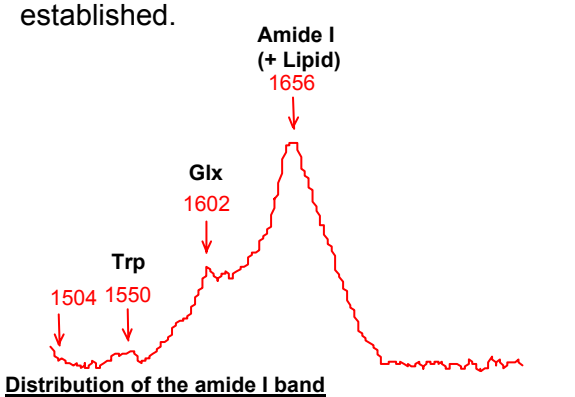
Raman Mapping

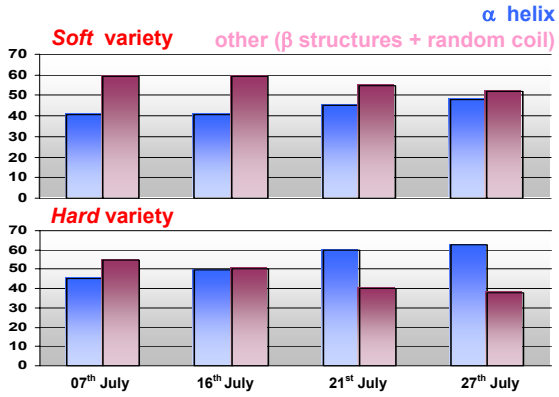


Grain Hardness

Careful analysis and band decomposition of the Amide I band between 1500 and 1700 cm^{-1} has allowed a correlation between the helical structure of proteins and the hardness of the grain kernel to be established.



Distribution of the amide I band



Summary

Raman analysis of a 50 µm section of a wheat grain kernel has allowed spectral features corresponding to starch, lipid and proteins to be identified.
The distribution of these components on the micron scale has been studied using a Raman mapped image.
Decomposition of the Amide I band allows a correlation between protein structure and grain hardness.

Acknowledgement

Data courtesy of Michel Manfait[a], Olivier Piot[a], Jean Claude Autran[b]

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