

The NIR side of lentil

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INTRODUCTION

The interest towards bioeconomy concepts has been considerably growing during the last years especially towards the development of sustainable and renewable bio-based technologies for food production.

One of the most interesting applications of bioeconomy in the “food” area is the **use of enzymes for the modification of food materials**, to improve safety and to optimize the overall treatment processes.

In this perspective, the present study was focused on two processes for treating lentil flour: extraction (E) and hydrolyzation (H), aimed at making protein available in solution, tested at different stirring rates. **Visible, near-infrared (NIR) and NMR spectroscopies** were used to obtain information about the evolution of the processes, by analysing samples collected at different time points, in the range between 0 and 300 minutes.

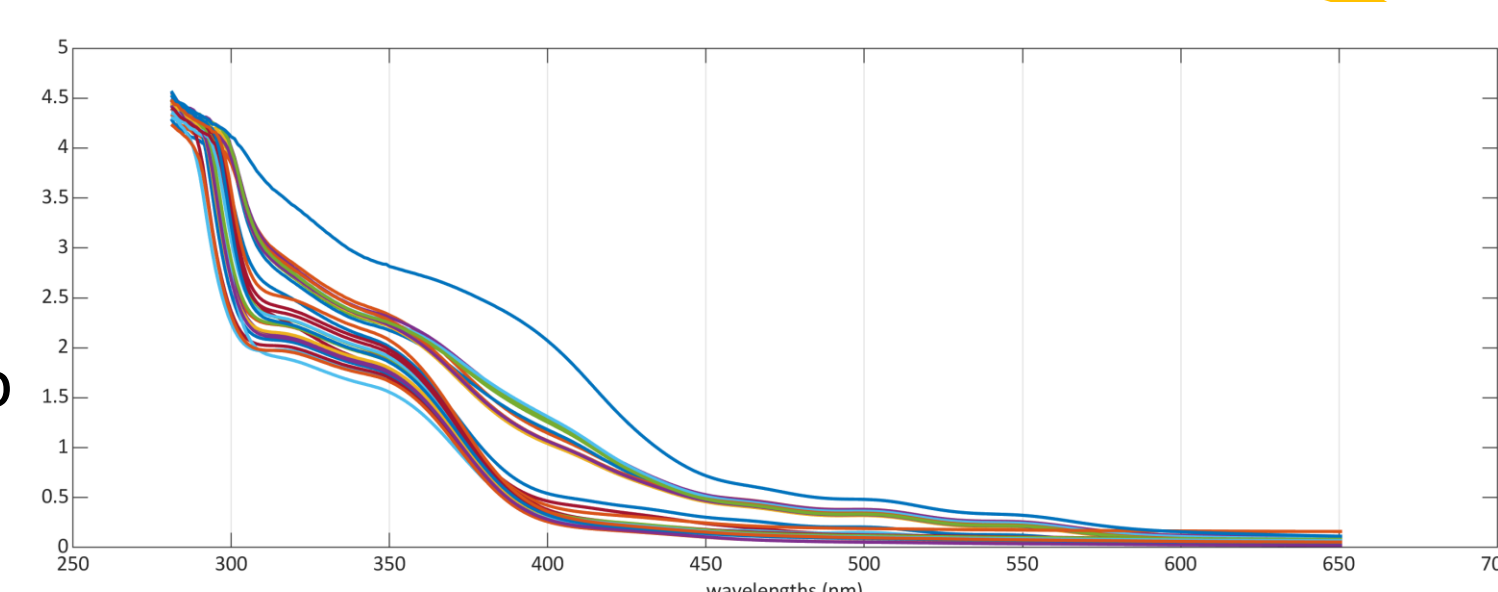
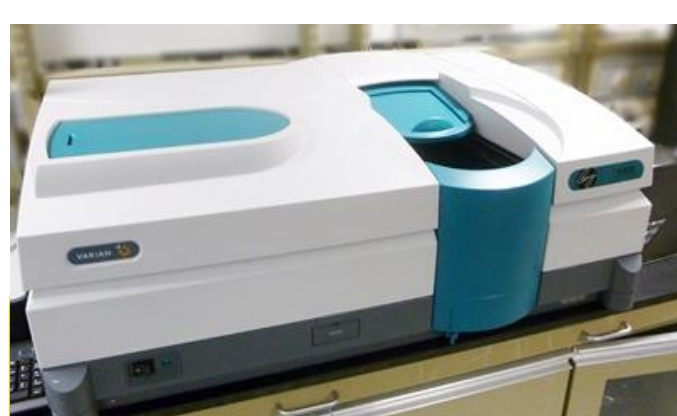
EXPERIMENTAL SETUP

- *For both processes:* initial extraction phase with $\text{Ca}(\text{OH})_2$ at pH = 8 and T = 60 °C
- *Hydrolyzation process:* 0.2 % of protease enzyme was also added
- *Samples:* 32 samples (12 of enzymatic extraction, 20 enzymatic extraction + hydrolysis)
- *Experimental time points:* 0 – 0.1 – 15 – 30 – 45 – 60 – 120 – 180 – 240 – 300 minutes
- *Spectroscopic instruments:* both benchtop, **Carey by Variant for the Visible spectra**, **MPA by Bruker for the NIR spectra**

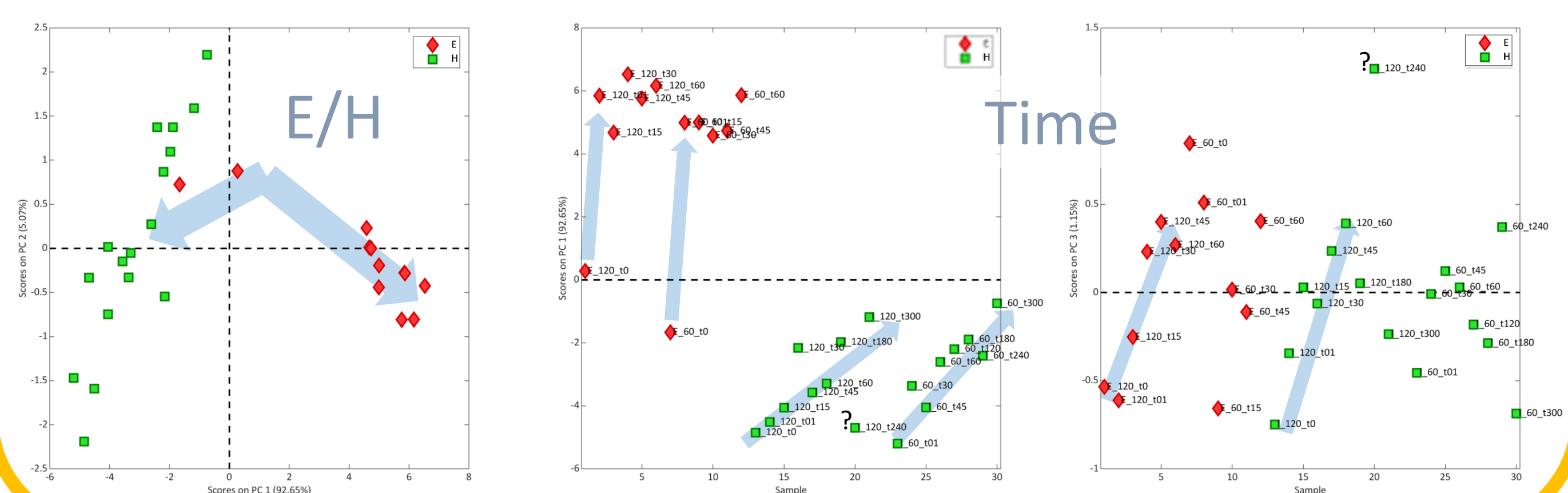


The extraction and hydrolysis process

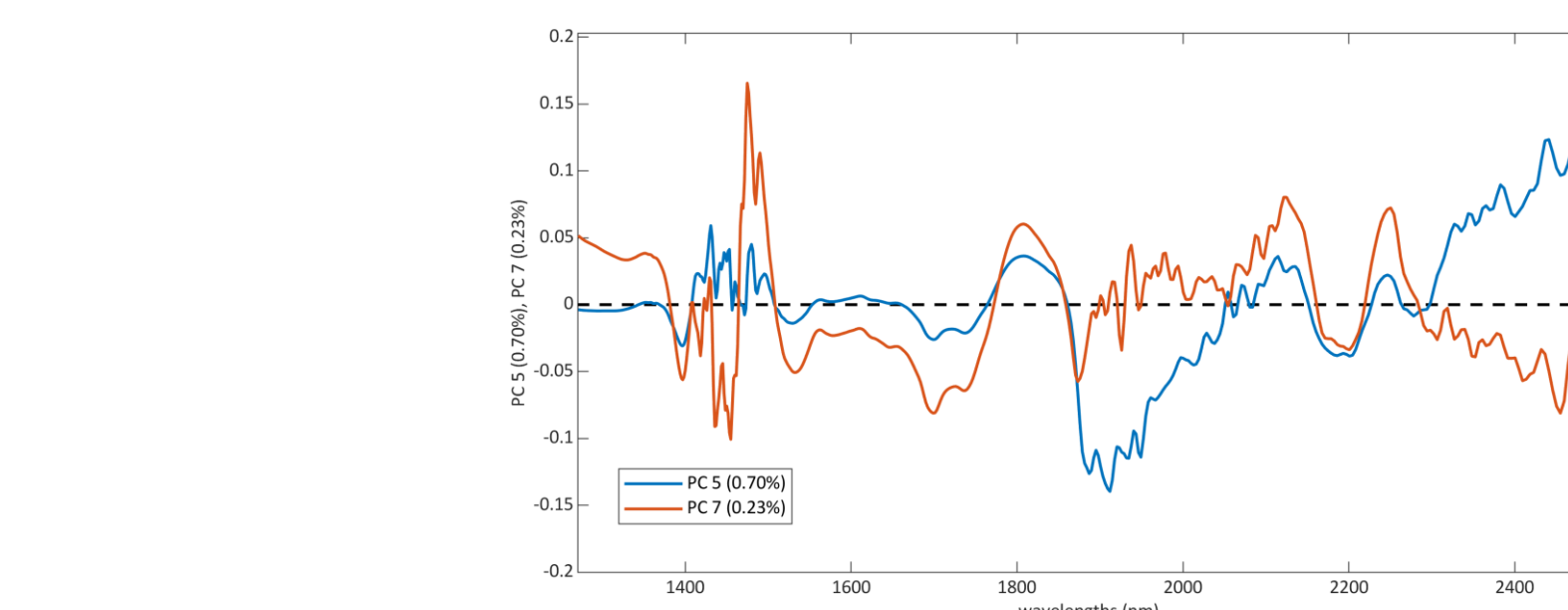
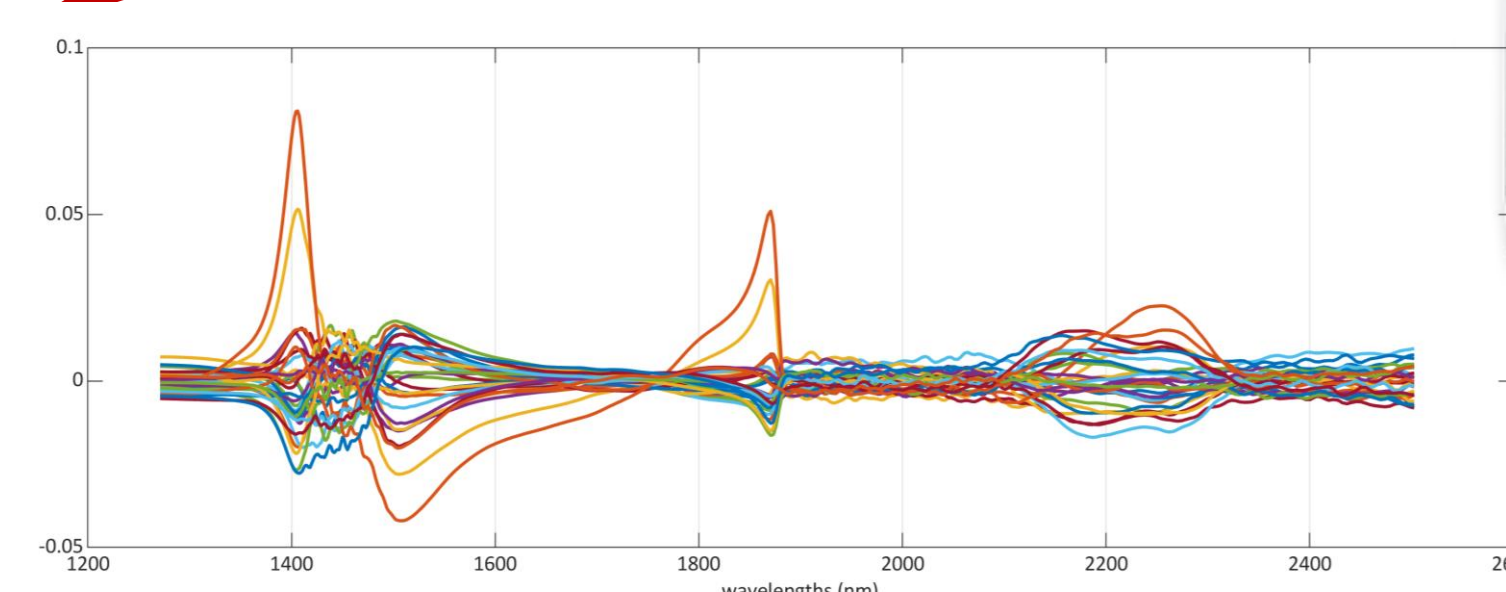
Visible spectra



- Very clear separation between the two processes (E/H): from the same initial colour, two directions arise.
- Not so clear trend according to time, but something can be seen, especially with the 120 rpm samples.
- No separation according to the stirring rate (60 vs 120 rpm) could be detected.



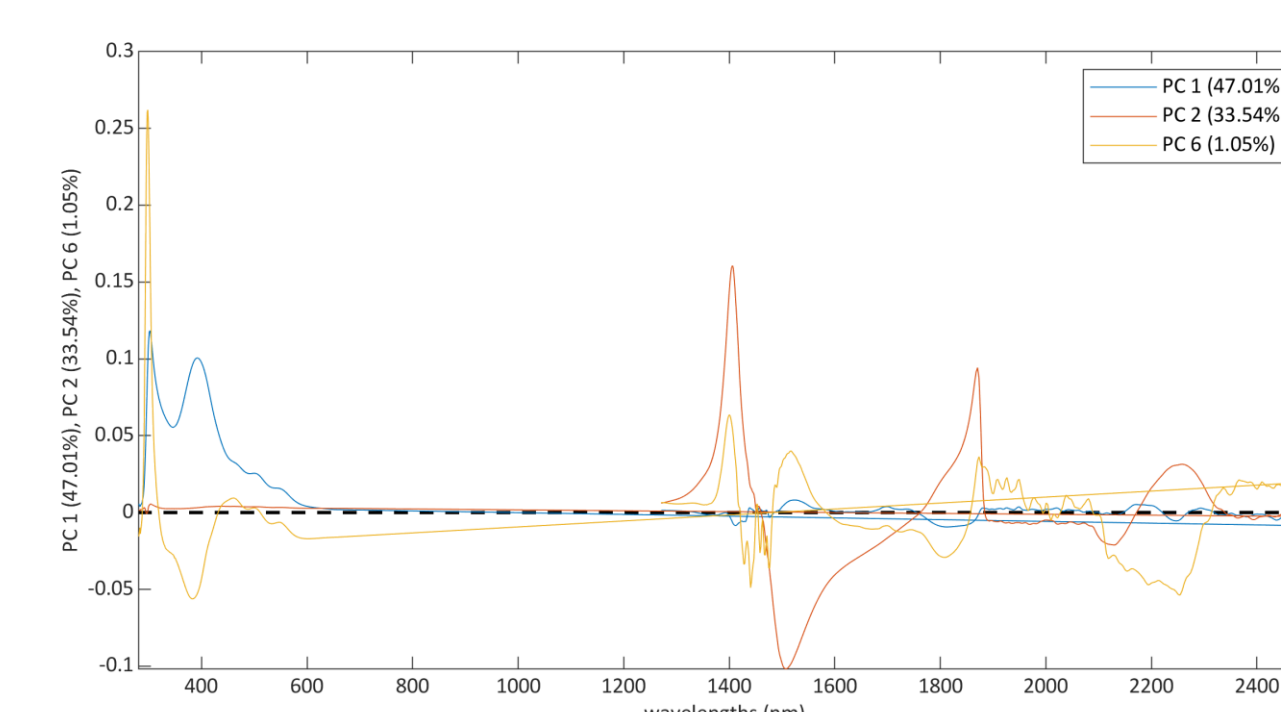
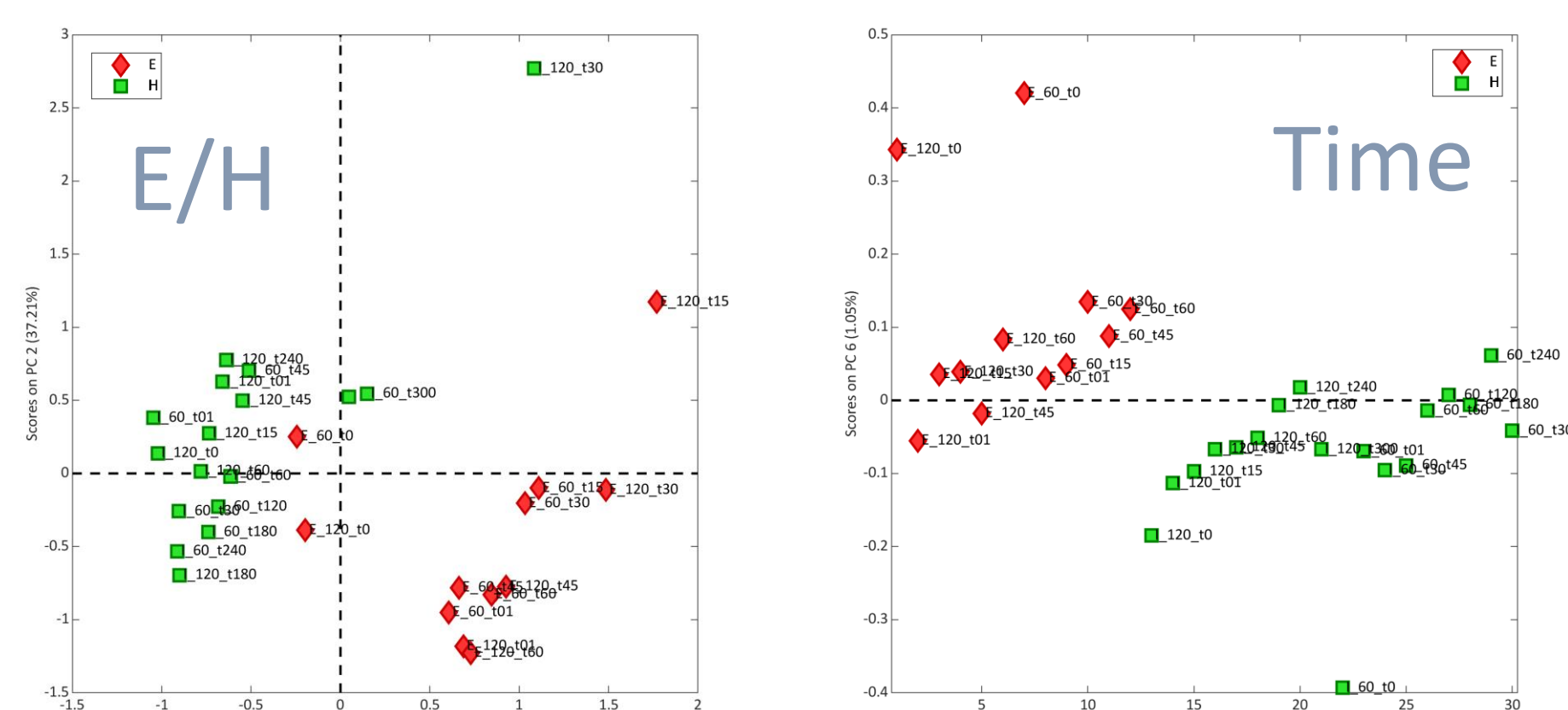
NIR spectra



- A small separation trend between the two types of process (E/H), but a rather high PCs (PC5 vs PC7, 0.93 %)
- Strangely, no separation according to the evolution in time could be detected by NIR spectroscopy.
- Also, no separation according to the stirring rate (60 vs 120 rpm) could be detected.

Low-level Data-fusion

- The very clear separation between the two processes (E/H) still holds.
 - Some subgroups emerge, but cannot be explained.
- Also here, a trend according to time could be detected.
- Still, no separation according to the stirring rate (60 vs 120 rpm) could be detected.



CONCLUSIONS

The obtained results suggest that Visible and NIR spectroscopies might not be the best choice for following and modelling the enzymatic extraction and hydrolysis processes of lentil flour, even if some indications could be obtained regarding the evolution in time.

This is a preliminary study, which was also coupled with nuclear magnetic resonance (NMR) spectroscopic acquisitions, which provided a clearer picture of the differences between the two processes. The poorer results obtained by Visible and NIR spectroscopies are probably due to the fact that from a general point of view the information contained in the data is not clear enough to be exploitable for following the processes' evolutions.