The potentiality of NIRS to monitor ethanol fermentation process at a laboratory scale

[1]S. Gofflot, [1]B. Lecler, [1]V. Baeten, [1]G. Sinnaeve, [1]P. Dardenne
[1]Walloon Agricultural Research Center, Quality Department, B5030 Gembloux, Belgium
E-mail : s.gofflot@cra.wallonie.be

Introduction

At a laboratory scale, alcoholic fermentation can be easily monitored by weight loss corresponding to the CO_2 released during the fermentation process.
This method has the advantage to be fast and inexpensive without any influence on the fermentation process. Since some other products are generated during the fermentation process the development of reliable tools for the monitoring the fermentation process is required.

This study investigated the potentiality of Near Infra Red Spectrometry (NIRS) for monitoring fermentation process at a laboratory scale.

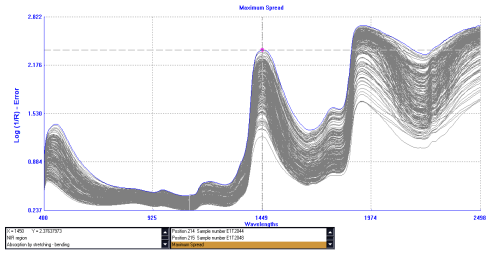
Material and methods

Hydrolysates of 5 wheat starch and 5 whole meal wheat samples were inoculated with a *Saccharomyces cerevisiae* strain in 1 liter erlenmeyer flasks equipped with an aluminium plate (3.8 X 10.9 cm) designed to cover the bottom of the flasks.

Flasks were weighted (at 0.01 g level) and NIR spectra were recorded (3 measurements) by placing the flask directly on the sample window of a FOSS XDS scanning monochromator. Spectra were acquired in transreflectance mode

Weight losses (WL) were converted in % (w/w) of ethanol :

Ethanol (EtOH) (% w/w) = (Weight loss/mediumWeight)*1.045*100.



Results and discussion

Available data were separated into a calibration set (n = 215) and a true validation set (n= 56) gathering all the flasks and all the replicates of one of the whole meal wheat.

The equations were developed by PLS applying a SNVD treatment and a slight smoothing (0,0,5,1) without any derivatives to the spectral data (1600-1850,2 2200-2492, 2).

	Calibration set			Validation set		
Constituent	**n**	**SEC**	**R^2C**	**n**	**SEP**	**SD/SEP**
WL	215	0.13	0.997	56	0.16	15.6
EtOH	215	0.24	0.995	56	0.28	10.0

Conclusion - perspectives

This study show the potentiality of NIRS to monitor ethanol production at a laboratory scale fermentation. Further development are needed to assess the substrate consumption (glucose) and the production of other fermentation metabolites (glycerol organic acids,…) determined by reference methods.

If these parameters can be validated, a powerful tool for multi-compounds monitoring fermentation process. Such a tool could be used for screening and selecting best microorganisms and/or substrates for second generation biofuels production.

Acknowledgment

The authors are grateful to Ms Anne Mouteau and Mr Willy Hannesse (CRA-W, Belgium)) for their technical support.

Walloon Agricultural Research Center, Quality Department
Chaussée de Namur, 24 – 5030 GEMBLOUX - Tél :++ 32 (0) 81 62 03 50 - Fax : ++ 32 (0) 81 62 03 88
dptqual@cra.wallonie.be - http://cra.wallonie.be