

Anaerobic digestion and near infra-red spectroscopy. Application to process monitoring through the development of 5 AD parameters models

Keywords: near infra-red spectroscopy, methane potential, volatile fatty acids, process monitoring

R. Tréguer^a, M. Poitrenaud^a, D. Rivière^b, J.A. Cacho Rivero^b

^(a) SEDE. 1 rue de la Fontainerie – CS 60175 – 62003 Arras Cedex – France

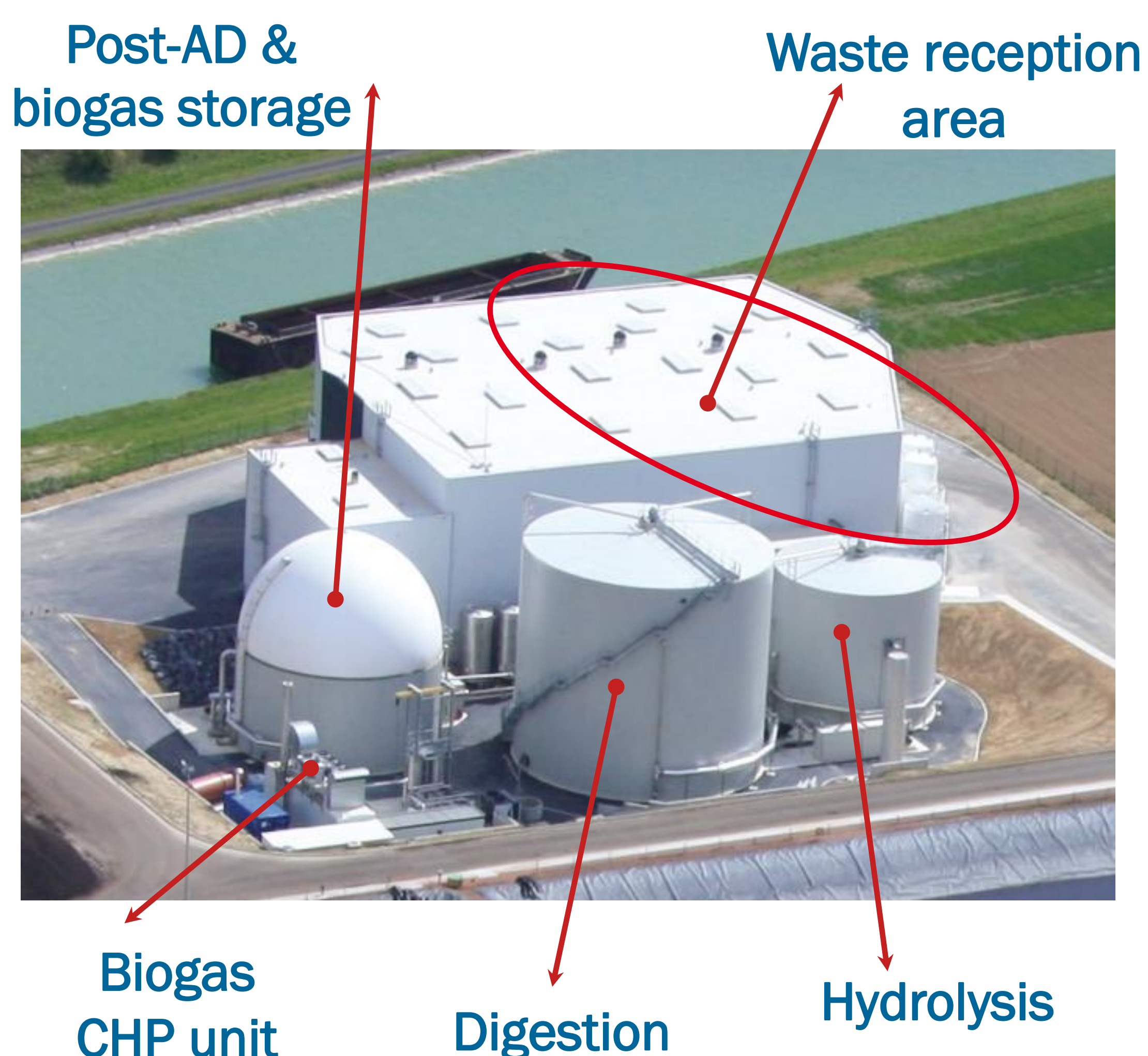
Phone: +33 (0)627 581 807 — E-mail: ronan.treguer@sede.fr

^(b) VEOLIA Recherche et Innovation. Zone Portuaire – 291 Avenue Dreyfous Ducas – 78520 Limay – France



Partner company: 

Background and motivation



Example of Artois Méthanisation plant (northern France)

- AD advanced treatment line, with several process monitoring points
- Large portfolio of highly diverse waste inputs
- Hence the requirement of close monitoring to ensure biological performance
- Currently, classical AD follow-up, throughout
 - DS, VS
 - VFAs, alkalinity, NH_4^+
- Downside: heavy lab work & delay in analytical responses

Objective → Develop an alternative real-time and online AD process follow-up system

Approach and methods

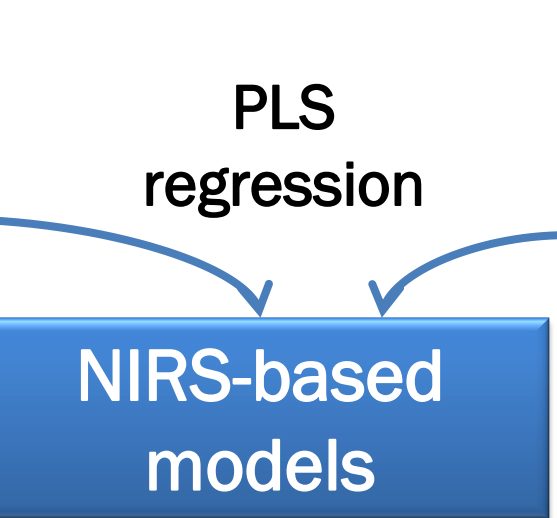
- Rely on the interest of NIRS when dealing with organics characterization
- Replace all classical lab methods by one single online measurement



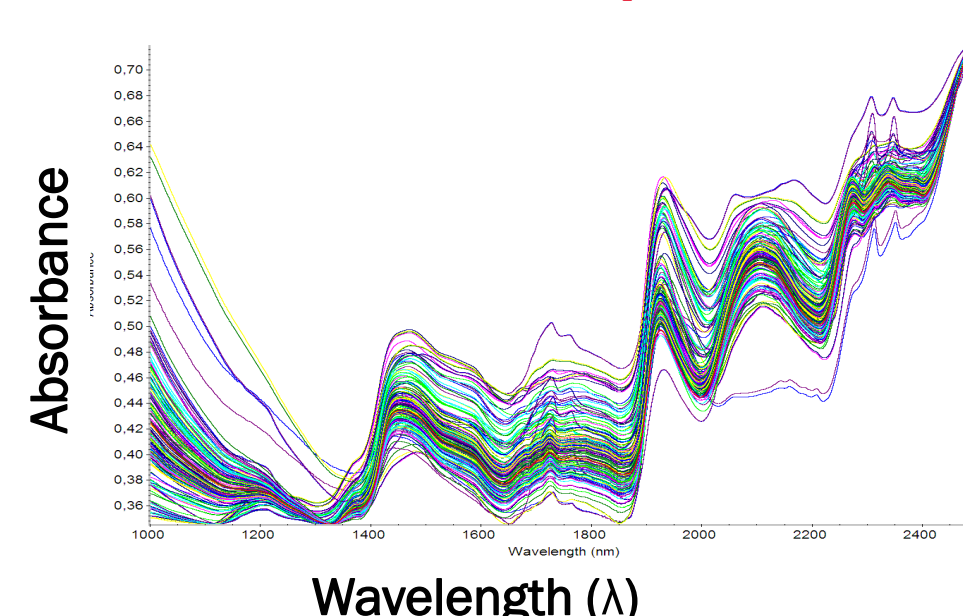
- For each parameter

Database of lab ref values

Sample	Reference value
S-1	150
S-2	650
S-3	340
...	...
S-n	25



Database of related NIR spectra



- Application to range of values commonly seen in liquid AD

Results and conclusions

- 4 optimal quantification models obtained: DS, VS, alkalinity and NH_4^+

Models	Parameter	Range	RMSE	Adj. R ²
Local PLS	DS	8.5 – 165 g/L	10.1	0.91
Local PLS	VS	4 – 159 g/L	7.2	0.93
Local PLS	Alkalinity	0.2 – 27.5 gCaCO ₃ /L	2.0	0.73
Local PLS	NH_4^+	0 – 6 gN/L	0.4	0.74

- 1 optimal classification model obtained: VFAs
 - PLS-DA modelling
 - 3 thresholds (0.25, 1.0 and 2.0 g/L)

Further work → Deployment on the field and implementation possibly with the use of miniaturized NIR probes