CH_4 emitted by dairy cows estimated from milk MIR spectra: model based on data collected in 7 countries

Amelie Vanlierde[1], Frederic Dehareng, Nicolas Gengler, Eric Froidmont, Michael Mathot, Michael Kreuzer, Florian Grandl, Bjoern Kuhla, Peter Lund, Dana W. Olijhoek, Maguy Eugene, Cecile Martin, Matthew Bell, Sinead McParland, Helene Soyeurt

[1] Walloon Agricultural Research Centre, Gembloux, Belgium, e-mail: a.vanlierde@cra.wallonie.be

Greenhouse gases (GHG) emissions from livestock and more especially methane (CH_4) emissions from cattle related to ruminal fermentations remain the most important source of GHG within the agricultural sector. Main levers to reduce those emissions are the diet and the genetic selection. To study the impact of those levers and how reduce CH_4 emissions, a large amount of reference measurements are needed. However, existing techniques to measure CH_4 emissions from dairy cows are expensive, time consuming and difficult to apply on a large amount of animals. This is why the availability of a robust proxy to estimate individual daily CH_4 emissions from dairy cows would be valuable. Estimate CH_4 emissions from milk mid infrared (MIR) spectrum present potential to meet this aim as it can be obtained routinely at reasonable cost through milk recording process. Develop this equation is particularly challenging as the CH_4 prediction equation from milk MIR spectra as CH_4 is not a direct milk component but an indirect phenotype linked to milk composition through ruminal fermentations which theoretically influence both. To increase the variability of the calibration set, two datasets (CH_4 measurements and milk MIR spectra) have been merged: A) 532 data from 156 cows of Ireland and Belgium using the SF_6 tracer technique; B) 584 data from 147 cows of Switzerland, United Kingdom, France, Denmark and Germany collected in respiration chambers. In addition of the calibration using the raw reference values, a second calibration was performed with a reduction of 8 % to CH4 values from chambers evaluate the need to correct the potential method bias in accordance with literature. A 5-groups cross-validation was performed to test the robustness of the models. Those equations showed a R^2 and a standard error of cross-validation of 0.63 and 62 g/day respectively for the calibration on raw values and 0.65 and 59 g/day when respiration chamber values are adjusted. The slight improvement due to adjustment of chamber measurement is not significant. With errors around 60 g/day, the current equations does not permit to distinguish slight variation of CH_4 emissions as it is often required in nutritional context. However, more variability is included (cows, breeds, diets, and country specific information), marked trends can be differentiated and statistics confirming its potential as proxy especially for genetic evaluations or life cycle analyses.

Keywords: Milk, Methane, dairy, MIR