DEVELOPMENT OF A METHOD TO PREDICT INDIVIDUAL ENTERIC METHANE EMISSIONS FROM COWS BASED ON MILK MID-INFRARED SPECTRA

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ABSTRACT

Agriculture is directly confronted to the problem of climate changes especially concerning methane (CH_4) emissions. Indeed livestock is considered as the largest CH_4 producer from anthropogenic sources mainly by ruminant's methanogenesis. In order to be able to decrease this emission by dairy cows, it is important to acquire an effective individual method to measure the CH_4 emission. This one has to be cheap, fast, accurate, and easily applied to a large number of cows. Based on the physiological mechanisms of ruminal digestion and lactation, there is an indirect relationship between milk composition (including fatty acids) and the production of CH_4. Therefore, working with milk mid-infrared (MIR) spectra seems to be relevant. Several equations have been built to predict individual methane emissions from the whole milk MIR spectra. For that four experiments were conducted on Holstein cows. They were selected according to their stage and number of lactation and received different types of diet to ensure a variation of the methane emission. The reference method used to measure the quantity of methane eructed within twenty-four hours was the sulfur hexafluoride tracer gas. In parallel individual milk samples were collected during each milking and analyzed by mid-infrared (MIR) spectrometry. The daily methane record was then related to an average of daily milk spectrum (AMS). Partial least square regressions were used to build the equations. The best CH_4 emission prediction (g CH_4/day) was based on 165 measurements and showed a cross validation R^2 of 0.74 and a ratio of performance to deviation (RPD) of 1.99. These first results suggest the possibility to predict individual methane emissions from milk MIR spectra. However, this equation will be refined by increasing the number of measurement in order to cover the entire existing CH_4 variability. Moreover, an external validation must be conducted by using independent predictions. By applying this equation on spectral databases (e.g., related to the regular milk recording), it will be possible to model the emission of enteric methane by dairy cows at small (i.e., intra-farm) and large (i.e., inter-farms, country, *etc*.) scales in order to develop management and selections tools. By this way, cows with low methane emission and high milk production could be selected and the best practices for the main production types could be identified.

Keywords: milk, methane, greenhouse gas, mid-infrared.