Measuring animal methane production

Jørgen Madsen and Najmul Haque

Department of Large Animal Sciences, Faculty of Life Sciences, University of Copenhagen, Groennegaardsvej 2, DK-1870 Frederiksberg C., Denmark

Abstract

Methane (CH_4) production of different animals, - especially ruminants -, has been under recent scrutiny mainly because CH_4 is a potent greenhouse gas, but also as CH_4 represents a loss of energy from the feed that potentially could have been utilized by the animal. Ruminant CH_4 production has traditionally been measured on individual animals in respiration chambers. Respiration chamber experiments are expensive, time consuming and constrain the animal to an un-normal behaviour in a un-natural environment whereby it produce non representative results. Therefore, other methods for individual measurements of CH_4 production have been developed. The most widely used is the sulphur hexafluoride (SF_6) method (Grainger et al., 2007). This method has given reasonable results, but with large variations (Pinares-Patino and Clark, 2008). Moreover, SF_6 is a strong greenhouse gas and its use has been banned in several countries. The latest developed method (Madsen et al., 2010) is based on using the animal carbon dioxide (CO_2) as a marker and by measuring the CH_4/CO_2 ratio in the air near the animal. By multiplying the CH_4/CO_2 ratio with the calculated CO_2 production the quantitative CH_4 production is obtained. It is found that the CH_4/CO_2 ratio in the breath and the portion of the gross energy that is released and lost as CH_4 is of numerical the same order and that the CH_4/CO_2 ratio most probably is a good indicator for the loss of gross energy in CH_4 for different animals fed a maintenance level energy diet and for animals with a limited production level. Moreover, the CH_4/CO_2 ratio can be corrected according to the level of mobilization, deposition or production and thereby be more generally used to compare the CH_4 of different animals and animals on different production level or in different production systems. This fast, simple and cheap method thereby offers new possibilities for measuring the CH_4 production in many situations. In Denmark more than 25% of the dairy cows are milked in robots and in such a robot the composition of the breath can be measured at every visit by a cow (about 60 cows 3 times a day). The many measurements create the basis for selection of cattle for low CH_4 production (Lassen et al., 2010, 2011) and for establishing the CH_4 production in livestock buildings (Bjerg et al., 2010, 2011) or for test of many different diets for cattle. Moreover, the CH_4 production of different species of animals can be established by measuring in the buildings housing the wild animals in the zoo.