Comparison of a flourometric and a fat-content-based method to measure carry-over in milking systems

Carry-over between milkings can affect sampling results that are used for herd management, breeding or diagnostic purposes in dairy cows. A flourometric method to determine carry-over was described in the ICAR Technical Series No. 14 by Løvendahl et al. (2010), where degree of carry-over could be calculated from a color saturation (C) ranging from pure white milk to milk colored with a yellow fluorescent dye. However, this method requires chemicals as well as a fluorometer, which may not be available at all test centres, while taking fat samples and determining fat content are routine tasks. Therefore a method that uses the fat contents (F) of normal bulk milk and skimmed milk to determine carry-over is compared to the fluorometric method with regard to precision and convenience of carrying out.

The comparison is carried out in two different conventional milking systems (a system with single-tube-guiding and a tilt-cup-based milk meter, A; and a system with a cluster and an electrical conductivity-based milk meter, B), in four devices each, at five different milk yields ranging from 3 kg to 20 kg. The “cow” is simulated by a set of artificial teats and silicon tubes (inner diameter 6 mm, length 0.9 m). For both methods two different liquids are prepared. Both methods use normal white milk as the reference liquid (W). The fluorometric method then uses yellow colored milk as a tracer liquid, while the fat method uses skimmed milk with a fat content of 1 % instead (T). For both methods liquids are alternated every two milkings, each starting with the T milk. Duplicate milk samples are taken from the bucket acting as the “cow” udder as well as from the milk sampler. Strictly separate sets of buckets and sampling utensils are used for the W and T liquids to avoid any experiment-based carry-over. The samples are analysed regarding color saturation and fat content, respectively. The results are then used to calculate carry-over for each milking system.

A linear covariance analysis model is used to test the effect of method (C, F) and milking system (A, B) as fixed factors as well as milk yield and an interaction between milk yield and milking system as covariables on carry-over. Heterogeneous variances between methods are considered with an appropriate covariance structure. Null hypotheses are that there is no difference between methods and no difference between milking systems, and there is no influence of milk yield on carry-over. These hypotheses are tested at a significance level of 0.05.

The results will indicate whether the methods can be exchanged without an effect on the carry-over estimation, whether there is a difference between the milking systems in test and if there is an influence of milk yield that may be also different between the milking systems.

Keywords: carry-over, sampling, milking, method comparison