Abstract

Development of a fibre-optic probe for non-invasive measurement of hematocrit in cattle

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Introduction

Bovine theileriosis is one of the serious threats for grazing cattle. The causative agent (Theileria *orientalis sergenti*) is transmitted by ticks. Early detection based on hematocrit measurement is vital both to save animal life and to prevent a pandemic spread in the herd. The aim of this work was to measure blood hematocrit non-invasively using short wavelength near infrared spectroscopy.

Materials and Methods

NIR spectra were obtained from various body parts of one immature and one mature cow. A custom-made near infrared spectrometer manufactured by Soma Optics Ltd (Tokyo, Japan) operating in the short wavelength region from 700 to 1050 nm at 1 nm intervals was used. A fibre-optic probe was customised to record spectra from various body parts including the vagina (external and internal areas), tail and neck. Probes used for external body parts included those with the distance between the illuminator and the detector of 20 mm (S size), 30 mm (M size) and 40 mm (L size). The probe inserted into the cow's vagina had four illuminators surrounding one detector and was 46 mm in diameter. In an experiment, 60 mature cows were studied. Hematocrit values were measured conventionally after centrifugation, the S size probe was used for external-vagina and tail measurements while an improved probe with a diameter of 32 mm was used for the internal-vagina measurements. PLS regression was used to develop a calibration equation based on full-cross validation.

Results and Discussion

NIR spectra taken from one immature and one mature cow indicated that the S size probe was appropriate for external measurements. Animal hair was a major interference to the spectra. Thus, when developing calibration equations, NIR spectra were measured only at locations where there was no or very little hair. Calibration results indicated that reliable measurements can be recorded at the tail area where large blood vessels are present. Further work is in progress to improve the instrument and the calibration equations.

Conclusion

To measure the hemotocrit of cattle non-invasively, a specially designed probe should be used to acquire NIR spectra in the short wavelength region from the blood vessels located in the tail.

Reference paper as:
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