

L.14.- Application of Near Infrared Spectroscopy (NIRS) to detection of Mammalian Meat and Bone Meal (MBM) in Feeds

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Reflectance spectra of feeds are easily acquired and provide an established means of quality control in the feed industry. It is appropriate then that the same technology could be used to screen feeds for mammalian protein that must be specifically excluded from the food chain because of the risk of transmission of BSE and vCJD to cattle and humans respectively.

Within Work Package 5 of the Stratfeed project NIR reflectance was studied extensively by partners in five laboratories using cloned spectrometers. Three sets (C, T and D) of laboratory prepared mixtures of compound feed containing meat and bone meal (MBM) at levels of 0, 1, 3, 5, 7 and 9 % (w/w) respectively were scanned in triplicate re-packing to acquire 2106 spectra from 700 specimens. Calibration models were constructed using quantitative MPLS and qualitative PLS2 discriminant analysis provided by the WinISI v 1.5 software of Shenk and Westerhaus.

Individual laboratories could achieve excellent calibration models having standard errors of calibration (SEC) and cross validation (SECV) typically in the range 1.0 to 1.5 % MBM. However performance usually degraded when standardised spectra were pooled across laboratories. This was attributed to the diversity of spectra of background feed matrices (GH statistic outliers) accumulated and some over-fitting by MPLS models having typically 16 or more factors. Some poorly mixed samples (t statistic outliers) were also implicated. Much better discriminant results were found if feeds were restricted in composition by segregating ruminant and non-ruminant feeds.

Nevertheless when the spectra of the laboratory prepared mixtures were combined with the spectra of 'real' processed compound feeds containing MBM, acquired by partner UCO prior to the ban, performance was apparently much improved. A model developed from this combined set of 1005 spectra (SECV = 0.94 % MBM; $R^2 = 0.97$) correctly assigned 8 samples in the validation set as well as giving acceptable performance in 54 compound feeds supplied by the co-ordination team for validation. Combining laboratory prepared specimens with 'real' specimens seemed to 'customise' the calibration to cope with real samples.

Although implementation of NIRS in industry is beyond the scope of WP5, our research suggests that NIRS is most appropriately implemented as a screening method within industry where there is an established product spectra library with a QC timeline for a particular product with running mean and SD. In this more restricted product range it may be possible to likewise customise the manufacturer's spectra database by incorporating reference spectra having a range of added MBM.

In this situation the main disadvantage of NIRS in having to acquire a large spectra library may be resolved at a stroke by taking advantage of the archive of spectra that already exists. Legislation could demand that product timeline surveillance becomes a regular facet of good manufacturing practice. This would benefit responsible manufacturers, their clients and consumers while lifting the burden on regulatory authorities allowing them to concentrate on referred suspect specimens that really warrant inspection.

Keywords :

Spectroscopy, NIRS, MBM, MPLS, PLS2, screening