AFTERNOON

AM 1: Agricultural Microscopy I

Chair(s): P. Ramsey, California Department of Food and Agriculture (retired), USA; and G. Kobata, California Department of Food and Agriculture, USA

Combination of Methods for Prohibited Animal Proteins Detection with a View to the Conditional Relaxation of the Total Feed Ban in EU. P. Veys, V. Baeten, European Reference Laboratory for Animal Proteins in Feedingstuffs (EURL-AP), Food and Feed Quality Unit, Valorisation of Agricultural Products Department, Walloon Agricultural Research Centre CRA-W, Gembloux, Belgium

At present microscopy is the sole official method in the EU for the detection of PAPs in feed. Although having proved to be very sensitive, microscopy has a limited potential to specify at species level the origin of the processed animal proteins. Alternative methods, such as PCR, NIR microscopy and immunoassays are necessary. Nevertheless none of the proposed alternative method is able on its own to fit all requirements for the accurate identification of prohibited ingredients from animal origin. Therefore and in order to offer the opportunity to implement a possible future species specific feed ban, a combinatory approach is required taking the respective advantages of each method. The lecture presents an overview of the potential of each method, as well as the proposed operational schemes combining the various methods with regard to the major final destinations of feed for the possible future implementation of the relaxation of the feed ban.

The Effect of Fine Particle Removal on the Estimation of Protein Degradability Parameters in Dairy Cows. Christian W. Cruywagen, Magdel Nel, Stellenbosch University, Stellenbosch, South Africa

Grinding of feedstuffs prior to *in sacco* incubation results in fine particles that could escape from dacron bags without being solubilized or degraded. The objective of this study was to determine the effect of fine particle removal on crude protein (CP) degradation parameters. Feedstuffs were soybean meal, sunflower meal, corn gluten feed, corn gluten meal and fish meal. Treatments were: 1. Grinding through a 2 mm screen with no subsequent sieving, 2. Grinding, followed by sieving through a 106 µm mesh, and 3. Grinding, followed by sieving through a 150 µm mesh. Degradation parameters were determined according to the NRC recommended *in sacco* degradation procedure in three lactating, ruminally cannulated, Holstein cows. Samples were incubated in the rumen for 0, 2, 4, 8, 12, 24 or 48 hours. On average, the crude protein a-values were 40.3% higher for the un-sieved treatments than for the sieved treatments. The effective CP degradability was also, on average, 43% higher for the un-sieved treatments. Grinding without the subsequent sieving of samples appears to result in an overestimation of CP degradation in the rumen.

Quantification of Maize Dust in Industrial Dust Filter Samples: A Case Study. Christian W. Cruywagen, Tanja Calitz, Stellenbosch University, Stellenbosch, South Africa

A broiler operation in South Africa that mixes its own feeds, uses corn as major ingredient. The corn is delivered by rail to a silo, from where it is transported to the farm by truck. The corn is pumped from the silo into the trucks and during the process a certain amount of corn dust is released into the atmosphere. The area around the railway site is covered with gravel and the frequent movement of trucks in the area generates significant gravel dust. Residents living nearby complained that dust in their homes was caused by maize dust and not by gravel dust from the railway site. An independent company that provides services in terms of occupational, health and safety solutions was contracted to conducted a series of dust bucket tests. Our lab was approached to analyse 16 dust samples collected from the bucket filter disks. It was established that starch granules are the major component of corn dust and because corn starch granules are easy to identify microscopically under polarized light, it was decided to use starch granules as the basis of

corn dust quantification in the filter samples. It was found that the dust samples contained less than 0.005% corn dust.

Microstructure of Starch as a Biodegradable Polymer. Delilah F. Wood[1], William J. Orts[1], Syed H. Imam[1], Bor-Sen Chiou[1], Gregory M. Glenn[1], Tina G. Williams[1], Darlene Hoffmann[2], [1]USDA, ARS, WRRC, Albany, CA, USA, [2]USDA, ARS, SJVASC, Parlier, CA, USA

Starch is a glucose polymer and one of the most abundant, naturally produced, plant polysaccharides in the world. It exists as granules with diameters from 1 to 150 μm and consists of linear amylose and branched amylopectin molecules with minor lipid content. Commercial sources of starch include corn, potato, wheat, and rice, although most plants produce starch. Understanding the microstructure of native starch in conjunction with its tissue associations can provide information on processing for commercial use. In addition, understanding the starch structure during its destructuring can lead to potential end uses. Starch can be plasticized and blended with compatible polymers to produce bioplastic composites that are biodegradable. The microstructure of the end products provides an opportunity to visualize how the starch interfaces with other polymers. As starch end uses expand and become more complex, such as the use of starch as supporting material or filler in biodegradable plastics and packaging materials, microstructural analysis becomes more and more important for analysis. We will show a number of different starches in their native forms, as isolates and in bioplastic prototypes.

Detection of Processed Animal By–products in Feedingstuffs by Near Infrared Microscopy. Ana Boix, European Commission, Geel, Belgium

One of the important measures taken by the European Union against the spread of bovine spongiform encephalopathy (BSE) was the introduction in 2001 of a total ban on the use of processed animal proteins (PAPs), for any animal farmed for the production of food. Lifting the feed ban provisions for non ruminants will require a further reinforcement of the control of feed for ruminants and therefore the availability of reliable analytical methods for detecting traces of PAPs regardless of their origin in compound feed is crucial. The only European official method to enforce the total feed ban is classical microscopy. Previous studies have demonstrated that NIRM is an objective, rapid, sensitive and highly-selective identification of animal particles in compound feed. In the frame of the European project Safeed-PAP the performance characteristics of a specific NIRM method, when applied to the detection of animal products in feedingstuffs were determined via a collaborative study. The method delivers qualitative results in terms of presence or absence of animal particles in feed and differentiates animal from vegetable feed ingredients on the basis of the evaluation of near infrared spectra obtained from individual particles present in the sample. The obtained specificity ranged from 86% to 100% and the required sensitivity for the official control (i.e. 0.1% meat and bone meal in feed) is achieved.

Corn Protein Blends, Part 1 - Moisture Sorption Behavior. K. Rosentrater[1], J. Verbeek[2], [1]Iowa State University, Ames, IA, USA, [2]University of Waikato, Hamilton, New Zealand

Corn-based ethanol has experienced exponential growth during the last decade. As a consequence, the production of byproduct corn protein meals, in the form of DDGS (distillers dried grains with solubles) and CGM (corn gluten meal) has grown as well. These materials are used as livestock feed. Extrusion processing is one method of converting these materials to value-added feeds, bioplastics, or other industrial precursors. The objectives of this study were to extrude blends of these materials, then examine dynamic and equilibrium relationships of extruded products with water. Blends consisted of DDGS:CGM ratios of 0, 33, 50, 66, and 100%. After processing, extrudates were placed in sealed chambers with headspace relative humidities ranging from 10% to 90%. Moisture contents were monitored over time. All samples achieve moisture equilibrium in less than three weeks. As with all biological materials, the extruded corn protein blends exhibited sorption behavior over time, the magnitude of which varied according to blend ratio. EMC values ranged from approximately 0% to nearly 50%, depending upon the humidity level and blend ratio. Nonlinear regression was successfully used to model the effects of relative humidity and blend ratio on the equilibrium moisture contents, with a coefficient of determination of 99%.

MORNING

AM 2: Agricultural Microscopy II

Chair(s): K. Koch, Northern Crops Institute, USA; and P. Veys, EURL Animal Proteins, Belgium

Chlorophyll Analysis by NIR. Veronique J. Barthet, Debbie Sobering, Canadian Grain Commission, Winnipeg, MB, Canada

Chlorophyll has a negative effect on canola oil and has to be removed during processing. In Canada, grains are marketed according to grades. Immature green seed count is a rapid method to assess chlorophyll. However, green seed counts will not give the real chlorophyll content. The purpose of the project was to assess if Near-Infrared could be used in an non-laboratory environment to measure chlorophyll content of canola samples in order to establish canola grades.The projects used 5 NIR instruments (Dickey-john Instalab 600) at industry locations and two instruments in a laboratory environment to establish repeatability, reproducibility, accuracy and sampling error. Railcars containing canola were sub-sampled and analyzed using a Dickey-john Instalab 600 at three primary elevators upon leaving and at two Vancouver terminal elevators upon delivery. Both primary and terminal sub-samples were sent to CGC Winnipeg where they were also analyzed using two Dickey-john instruments.Results showed no statistical difference between the NIR results obtained by the various instruments at the different locations. No statistical difference between the terminal and primary sub-sample results were observed using the two instruments in Winnipeg suggesting that sampling had no effect of the chlorophyll measurement. The results suggested that the tested NIR could be used to accurately measure chlorophyll in canola samples.

NIR Spectroscopy for Disclosure of Toxic Plant Material in Feed Production. P. Veys, J.A. Fernández Pierna, V. Baeten, European Reference Laboratory for Animal Proteins in Feeding Stuffs (EURL-AP), Food and Feed Quality Unit, Valorisation of Agricultural Products Department, Walloon Agricultural Research Centre CRA-W, Gembloux, Belgium

Rapid and accurate detection methods for the adulteration of plant contaminants in food and feed remain a challenging requirement for the industry and the control authorities. Classically, such sources of contamination are analyzed by the identification of toxic molecules using analytical chemistry techniques as HPLC, GC-MS, etc. The work presented here shows an alternative analytical strategy for the disclosure and identification of toxic contaminants. The cases studied comprise the detection of rye ergot in crop production systems and poisonous Senecio species in hay, both based on their spectral signature obtained by recent developments of rapid and non-invasive near-infrared spectroscopic methods. The potential and the advantages of such new approach will be discussed.

Efficient Extraction of Carotenoids (Canthaxanthin) from High Titre Escherichia Coli Strain. M.A. Scaife[1,2], C.A. Ma[1,3], R.E. Armenta[1], [1]Ocean Nutrition Canada Ltd., Dartmouth, NS, Canada, [2]University of Cambridge, Cambridge, UK, [3]Southampton General Hospital, Southampton, UK

Canthaxanthin is widely used as a feed supplement in aquaculture and poultry industries, as well as in cosmetic and nutraceutical markets. Production is currently dominated by chemical synthesis. However, changing consumer trends are fuelling research into biotechnology based production processes. Reported metabolic engineering approaches for producing carotenoids have achieved titers of > 300 mg/L. However, efficient extraction remains a significant hurdle. We present a novel 2-step extraction procedure for canthaxanthin extraction from Escherichia coli biomass. This method sequentially employs methanol and acetone to extract >3 fold total canthaxanthin after a single pass, compared

to repeat extraction (n=3) of the same biomass with a single solvent. Subsequent investigation into solvent to solvent and solvent to biomass ratio reduced solvent use without loss in efficiency. This extraction method holds potential for large scale extraction of carotenoids (canthaxanthin) from biological material.

Unlocking Nutrients from Fibre with Exogenous Fibrolytic Enzymes in Ruminant Nutrition. Christian Cruywagen, Francois Van de Vyver, Stellenbosch University, Stellenbosch, South Africa

Four forages were treated with exogenous fibrolytic enzymes (EFE) and evaluated *in vitro* and histologically. For histological evaluation, leaf tissue of kikuyu and weeping love grass and stem tissue of alfalfa hay and wheat straw were used. The forages were also incubated in buffered rumen fluid for the determination of *in vitro* digestibility. Degradation of cell wall components were quantified using image analysis software. Digestibility data were subjected to a Factorial ANOVA, whereas histology data were analyzed with either a Bonferroni or Newman-Keuls multifactorial test. *In vitro* digestibility was higher for EFE treated alfalfa and kikuyu after 24h of incubation ($P < 0.05$). Cell walls of the metaxylem of kikuyu and weeping love grass leaf material were thinner for the EFE treated samples after 12h of incubation ($P < 0.05$). There was a significant thinning effect of EFE on the cell wall of phloem after 12h of incubation for kikuyu, as well as the adaxial epidermis at 24h. The abaxial epidermis at 12h was thinner for weeping love grass treated with EFE. There was a definite, though subtle thinning effect of EFE on cell wall thickness of plant material which could be indicative of the mode of action of EFE.

WEDNESDAY

N/A