

Total Enterobacteriaceae counts as an indicator of animal feedingstuffs hygiene.

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Introduction Bacteria belonging to the family Enterobacteriaceae enter the animal feed chain as normal contaminants of raw materials used in the manufacture of animal feeds. The family Enterobacteriaceae encompasses 30 established genera, including *Salmonella* spp, *Escherichia* spp, *Shigella* spp and *Yersinia* spp. Many of the genera exhibit pathogenicity towards man, animals, insects and plants and many of the pathogenic forms produce toxins. A number of the genera in this family occur regularly in association with animals; they are found as indigenous members of the gut microflora where they may either produce no harmful effects, or are capable of causing disease in both endothermic and ectothermic animals. There is a recognised association between the risk of isolation of salmonella and degree of Enterobacteriaceae contamination (Veldman *et al.* 1995). This has led to the consideration of recording Enterobacteriaceae contamination levels in feed stuffs as an indicator of feed hygiene and potential limits to the degree of contamination being set by the major retailers. This paper sets out data gathered from the routine analysis of feed raw materials examined for Enterobacteriaceae contamination.

Materials and Methods. Feed samples were analysed for their Enterobacteriaceae contamination using a Malthus System V impedance analyser. Test cells containing growth medium supplied, are inoculated with a suspension of the feed sample, these cells are then placed in the analyser and left for 24 hours. The analyser monitors changes in impedance in the cell due to microbial growth and records this data as a graph. Using calibrated software the point of change from lag phase to log phase growth rates are determined. This is referred to as the detection time. A calibration curve is generated using this detection time data and manual colony counts on Violet Red Bile Glucose Agar (VRBGA). The calibration curve can then be used for routine analysis of samples using the system to generate an estimate of the number of colony forming units present per gram of sample. A total of 396 samples of wheat and 939 samples of soya were analysed. Mean colony forming units (CFU:log10) were compared using the Student t-test.

Results. Raw materials can be classed as either unprocessed (whole cereals) or processed (oil seed meals and animal proteins). The mean CFU (log10) of wheat (n=396) which is a material that is not routinely processed were 5.046 log10 (range 10^1 – 10^7 CFU/g)(Figure 1). Soy bean meal including full fat, hy-pro and soya bean meal (n=939) which is a product that is processed showed a bimodal distribution with a high number of samples with very low Enterobacteriaceae counts (Figure 2). This is probably due to the processing environment which has reduced Enterobacteriaceae counts. A second population of samples with a peak at 4.986 log10 CFU/g indicates the high degree of recontamination which has occurred. When the samples with $<10^1$ CFU/g were removed from the soya data set there was no significant difference between the mean CFU/g of the wheat or processed soya ($P>0.05$; SE 0.7612 log10).

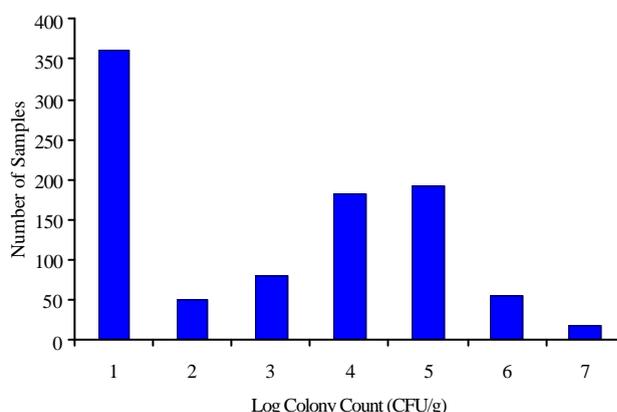
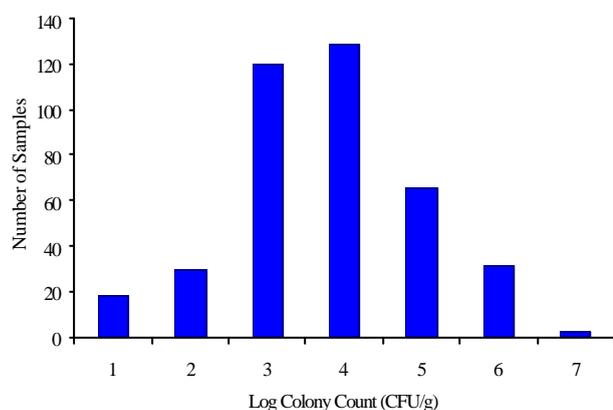


Figure 1. Enterobacteriaceae contamination of wheat **Figure 2.** Enterobacteriaceae contamination of processed soya

Conclusion The data indicates that a large proportion of the raw materials used for animal feed manufacture are contaminated with significant levels of Enterobacteriaceae ($>10^4$ CFU/g). In the present climate every effort must be taken to eliminate contamination of food and feed with pathogenic bacteria. Processing the raw material has the potential to reduce this degree of contamination. The level of natural contamination found in the raw materials is sufficient to indicate the requirement for further processing either via heat or chemical treatment. This contamination of raw materials should be viewed as a critical control point for the entry of pathogenic bacteria into the feed and food chains.

References

Veldman, A., Vahl, H. A., Borgreve, G. J. & Fuller, D. C. (1995). A survey of the incidence of the *Salmonella* species and Enterobacteriaceae in poultry feeds and feed components. *Veterinary Record* **136**. 169-172.