Co-products for Animal Feed

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A number of feed materials are the result of simple processing that yields only a single product. Other processes divide the raw material into a number of different fractions, all of which may be regarded as co-products, and some of these are used as animal feeds. Of the 638 feeds listed in the EU Catalogue of Feed Materials[1], approximately 60% are co-product feeds, and they are of particular interest because many are the result of processing carried out in other industries by people whose major concern is not the animal feed fractions. Consequently, these fractions may be subject to change as processors strive to obtain a greater proportion of their primary product, or respond to changes in demand. Although one fraction may have more monetary value than another, they all contribute either positively or negatively to the total value of the process and, in some cases, they may be essential to its viability.

From both the commercial and environmental viewpoint it is important that, however many fractions are produced, collectively they account for 100% of the raw material - or as close to 100% as can be achieved. This point does not appear to have been fully appreciated by all research workers but it is important to ensure that, whenever a useful extract is identified, there is an accompanying reference to the use of the extracted residue.

The animal feed industry can be a useful partner that enables this objective to be met. It currently makes good use of co-products from a wide range of processes, and is usually able to accommodate changes to the material when modifications are made to the process. The feed industry is demanding in terms of transparency and feed safety - remember it is part of the human food chain - but its requirements are flexible and relatively undemanding. It is no problem if there is significant variation between different co-product fractions or, for instance, potato crisps or chips contain a mixture of coatings or seasonings. However, it would be of note if such coatings reduced the uptake of oil, which is a valuable, high energy component of the feed material. There may also be concern about strong smelling or tasting co-products that have the potential to discolour the milk or taint the meat: beetroot co-products can be a problem and onion fractions may be unwise. The flexibility arises because the industry uses most feed materials as a source of nutrients, and not an end-product. Thus, a wide range of materials - from seed husks to the nutrient-rich residues of extraction processes - can be accepted and incorporated into balanced formulations by combining the material with other types of feed. If the composition of the co-product changes, the animal feed customer can probably accommodate the new material, though the formulations may need to be changed. Thus, changes to the process should not be introduced without prior discussion because the feed industry may need time to consider the implications, which may affect their perceived value, or even be hazardous. Feed safety necessitates control of the entire production chain: when changes are being considered at any point, the potential consequences for those further down the chain - both animals and humans - must be taken into account.

Undesirable substances are not limited to toxic factors; it is important to recognise that the excessive use of water is an undesirable practice when it results in high moisture co-products. The feed industry's ability to handle liquids is quite limited. Pig farms can handle liquid feeds but only if they have invested in a pipeline feeding system. Ruminant farms may be able to handle a syrup, but they rarely feed liquids. Cost must also be borne in mind. High moisture feeds are expensive to transport when those costs are expressed per unit of feeding value - a 29 tonne load of feed containing 10% dry matter is twice as expensive to transport as one containing 20% dry matter. Thus the use of excessive amounts of water in a process may render the co-product unacceptable as a feed, or too expensive to deliver. This is a problem that has plagued the Scotch whisky industry for a hundred years and more. Following distillation, the residual liquor contains 96% water and, although some is evaporated to a syrup, its significant moisture content makes it too costly to deliver to many of the livestock farms in England. Much of it is dried, but that too is an expensive practice. Thus it was recently noted that the majority of this liquor is disposed of rather than used as animal feed[2].

Happily, you should be aware that the animal feed consumers are very accommodating. Fibrous feeds, such as those including the seed hulls or the pulps of sugar and starch extraction can be useful, and even valuable feeds for ruminant animals - thanks to their development of a digestive system that involves pre-treatment by both fermentation and mastication. The growing pig does not possess such capability but the sow has an effective post digestive fermentation system, and all pigs have a reputation for consuming almost anything they are offered - they have a high omnivoric capacity! As an example, the digestibility of the energy in soyabean hulls has been measured at 47.3% for growing pigs, 71.2% for sows and 80% for the ruminant animal[3]. With respect to high moisture feeds, the sow has a notable capacity: in a trial in Scotland sows consumed up to 50 litres per day of pot ale, which contained only 4% dry matter[4]. If a feed can be delivered to farm at a competitive price, the livestock will usually eat it.

One final point must also be considered, and that's the mineral content. Most plants have a relatively low mineral content and mineral supplements are typically needed when they are fed to productive classes of stock. But when the plant is extracted the mineral content of the extracted fraction increases. When rapeseed is crushed the mineral content doubles; when maize grain is converted into bioethanol the mineral content of the residue increases three-fold. And further extraction of co-products sometimes occurs: I was recently shown an analysis of one such residual fraction that contained 45% ash in the dry matter. All of these mineral-rich fractions can potentially be accommodated by the feed industry, given time to consider the possibilities - and preferably that the composition is consistent - but problems have occurred in the past. Some fractions contain an unnaturally high sodium concentration due to processing that involves pH adjustment with sodium hydroxide: these feeds have resulted in the death of pigs. A more recent problem occurred in the United States when the use of sulphuric acid in bioethanol manufacture led to hydrogen sulphide toxicity in cattle[5].

References:

1. EU/2017/1017 Commission Regulation of 15 June 2017 amending Regulation 68/2013 on the Catalogue of feed materials.

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5. Schoonmaker J P and Beitz D C (2012) Hydrogen sulphide: synthesis, physiological roles and pathology associated with feeding cattle maize co-products of the ethanol industry. In: Biofuel co-products as livestock feed: opportunities and challenges, ed. H.P.S. Makkar, FAO Rome, 101-113.