Is melamine the perfect evil?
The high-protein fake can harm, but beware – there’s worse ingredients

BY ANDY HOR

Melamine is a relatively cheap industrial chemical that is readily available, fairly non-toxic, water-soluble and, most significantly, super-rich in nitrogen.

Foods that are high in proteins such as dairy products, wheat and corn gluten, soya and rice protein concentrates, are widely accepted as nutritious, and can command high prices.

Melamine and protein are as different as chalk and cheese. They do, however, share one common feature – high nitrogen content.

In fact, melamine has more than five times the nitrogen found in protein, a common amino acid in milk proteins (casein).

This was what led to the devise use of melamine as a cheap “high-protein fake” to falsely boost protein readings. It has been pumped into everything from milk to pet food ingredients.

One kilogram of melamine costs about $50 in Singapore, but just $2.50 at its source in China. This is enough to dope more than 100,000 litre-cartons of the most contaminated milk found!

The bad news is, melamine is not the only “non-protein nitrogen”.

Nor is it the worst ingredient you could find.

Other common examples include urea and ammonium nitrate.

There are known cases of urea (and its derivative) being put illegally into products such as wheat. As for ammonium nitrate, it is used widely as fertiliser and can make its way into the food chain.

Their use as illegal food additives escapes routine detection because many commercial quality control processes merely test for the total nitrogen content of the proteins, not the protein itself. This is because testing protein is both costly and tedious, particularly since milk has a complex mix of proteins.

This is the root of the problem.

There are established methods to detect melamine and other non-protein nitrogen, but they are not part of routine checks.

Proper milk-testing equipment looks for “peptide bonds” using a process called spectrosopy as a direct measure of real protein.

The Food and Agriculture Organisation of United Nations also recommends that the protein content in milk be confirmed by amino acid analysis because testing nitrogen content itself can be misleading.

However, it also says that detection based on total nitrogen content is an “acceptable” alternative only when good data are not available, because complete protein testing costs more and takes much longer – important considerations for a manufacturer or testing lab.

Melamine is not a potent toxin and many healthy adults can get rid of it by metabolising or passing it out in our urine.

The problem is, break-down of melamine is very inefficient and when it degrades, it gives rise to another nitrogen-containing chemical – cyanic acid.

Like melamine, its toxicity is low, but when these two combine, they form a crystalline complex that precipitates as a solid.

This can lead to kidney stones, renal failure and death in infants and pets, who are less efficient in getting rid of the chemicals.

A complete ban on melamine would not be the solution, although licensing would be useful.

Its toxicity is not high and it is a useful material for plastic, resins, coating materials, flame retardants and dyes.

More importantly, it is just one of the many nitrogen-rich chemicals known.

It is easily made from urea, which is a common fertiliser. Urea itself comes from ammonia, which is another useful nitrogen compound.

Unlawful use of hydrazine in food would be far worse, since it is a carcinogen. Nearly 90 per cent nitrogen, hydrazine has numerous industrial uses including foaming agents and anti-oxidants.

Cyanomazine is another chemical that we should watch out for. It is a derivative of melamine, often used as pesticides and can be taken up by plants as melamine. Its presence in tomato paste is already an issue.

The easy answer is, of course, to widen the net and test for all possibilities, but this is very impractical.

What we should do is to have a balanced approach, taking into account cost, time, manpower and safety, and establish a system to include checks on melamine and its derivatives.

Periodic checks can be done on protein, especially on high-protein goods, as well as spot checks for other artificial nitrogen enhancers.

We need to better equip our quality assurance labs, both at the factory and distributor levels, and at the enforcement level.

These, however, should not be done at the expense of stifling the business.

We must protect consumers’ interest without killing the market.

We can draw comfort from the fact that melamine and its nitrogen-rich relatives are actually “low-grade” protein counterfeits because chemically, they are very far off from proteins, and can be detected easily by our current armory of analytical techniques.

We should, however, watch out for the possible event that “high-quality” fakes are deliberately developed to beat detection techniques.

Vigilance, with the help of science, is our best defence.

The writer is president of the Singapore National Institute of Chemistry, and head of Chemistry Department at the National University of Singapore.