

Editorial

Melamine contamination of food products

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Melamine is an organic base and a trimer of cyanamide containing 66% of nitrogen by mass. Melamine is combined with formaldehyde to produce melamine resin, a very durable thermosetting plastic, and melamine foam, a polymeric cleaning product. The end products include countertops, dry erase boards, fabrics, glues, housewares and flame retardants¹.

Between the late 1990s and early 2000s, both consumption and production of melamine grew considerably in mainland China. By early 2006, melamine production in mainland China was reported to be in "serious surplus"¹. Surplus melamine has been a popular adulterant for feedstock and baby formula in mainland China for several years because it can make diluted or poor quality material appear to be higher in protein content by elevating the total nitrogen content detected by standard protein tests¹. It is estimated that about 20% of the dairy companies tested in China sell products tainted with melamine¹.

Melamine is not metabolized and is rapidly eliminated in urine. No human data is available on the oral toxicity of melamine but data from animal studies show it to have a low acute toxicity². Animal studies suggest that when combined with cyanuric acid it can cause fatal kidney stones due to the formation of an insoluble melamine cyanurate¹. When melamine and cyanuric acid are absorbed into the bloodstream, they concentrate and interact in the urine-filled renal microtubules, then crystallize and form large numbers of round, yellow crystals, which in turn block and damage the renal cells that line the tubes, causing the kidneys to malfunction¹.

In 2007, melamine was found in pet food manufactured in China and exported to the United States of America, causing the death of a large number of dogs and cats due to kidney failure³.

On 11 September 2008, Chinese media reported that Sanlu brand infant formula produced by Hebei-based Sanlu Group was contaminated with melamine³. Sanlu's powdered infant formula is widely consumed by infants across China because it is relatively more affordable than others. Following inspections

conducted by China's national inspection agency, at least 22 dairy manufacturers across the country were found to have melamine in some of their products³. More than 54,000 infants and young children have sought treatment for urinary problems, possible renal tube blockages and possible kidney stones related to the melamine contamination of infant formula and related dairy products with more than 12,800 hospitalizations and four infant deaths³. The level of melamine found in the contaminated infant formula has been as high as 2,560 mg per kg ready-to-eat product, while the level of cyanuric acid is unknown⁴. Both WHO and FAO have used the International Food Safety Authorities Network (INFOSAN) to inform and update national food safety authorities on this food safety crisis⁴. Why this problem is not more widespread, given the rather large number of infants potentially drinking contaminated formula-milk for months is unclear³. Sources in China have now revealed that Sanlu was aware that its products were contaminated with melamine as long ago as December 2007. Fonterra, the New Zealand dairy company and 43% stakeholder in Sanlu, claims to have approached the Chinese authorities as soon as it heard about the problem but was held back from going public because of the imminent Beijing Olympic Games. However, Fonterra cannot blame Chinese regulations for failing to warn consumers as soon as it knew about the contamination⁵.

Symptoms observed in infants affected by the melamine-contaminated infant formula in China include unexplained crying, especially when urinating, vomiting, haematuria (macroscopic or microscopic), oliguria or anuria, stones discharged while passing urine, high blood pressure, oedema, and pain when knocked on kidney area³.

In recent weeks, scientists have started to conduct experiments and testing, designed to determine the safety threshold of melamine when it comes to ingestion in contaminated and melamine-tainted foods. This has led many researchers and scientists to suggest that a small amount of melamine is non-toxic and "safe" but the debate over the deadliness of melamine continues. To date, there are conflicting opinions within the scientific community about

whether a small amount of melamine is "safe"; so cautious and concerned consumers are opting to play it safe and avoid all products - especially potentially melamine-tainted baby formula - that's associated with recent melamine-related food recalls. U.S. health officials on 3rd October, 2008 unveiled what they consider acceptable levels of contamination with melamine. "In food products other than infant formula, the FDA concludes that levels of melamine and melamine-related compounds below 2.5 parts per million (ppm) do not raise concerns." The FDA says that the scientific community has been unable to determine a "safe" melamine exposure level for babies who consume melamine-tainted baby formula⁶. With regard to the content of melamine and its analogues in infant formula the risk of adverse health effects is considerably higher because the infant formula makes up 100 per cent of an infant's diet and because the renal systems of infants and toddlers are not yet fully developed. The reporting standard for melamine and its analogues in these products should therefore be lower than the level of other food products⁷.

Until the 2007 pet food recalls, melamine had not routinely been monitored in food. This could be due to the previously assumed low toxicity of melamine, and the relatively expensive methods of detection. Following the 2008 health scare in China over powdered milk, the Joint Research Centre of the European Commission set up a website regarding methods of detecting melamine (<http://irmm.jrc.ec.europa.eu/melamine>). In October 2008, the U.S. FDA issued new methods for the analysis of melamine and cyanuric acid in infant formulations in the Laboratory Information Bulletin No 4421¹. Similar recommendations have been issued by other authorities, like the Japanese Ministry of Health, Labour and Welfare¹.

Products across the globe containing milk imported from China seem to have been affected and authorities from Australasia and Asia to Europe and the USA are withdrawing formula milk, coffee and tea drinks, candies, soup, cheese powder, biscuits, ready-made desserts, and chocolate⁵. "Melamine" used in furniture is a polymer resin made from the small organic molecule melamine and formaldehyde, and there is no need to worry about using melamine cooking utensils or eating off a melamine-coated kitchen table⁵.

On 17th October, 2008 Sri Lanka banned the sale of sixty products, including popular brands of imported chocolates, cakes and other frozen food products, as a precaution to check whether they contained the

tainted melamine⁸. Wide range of these products, which also includes savoury snacks, frozen deserts and milk and yoghurt products, mostly imported from China, were taken off the shelves, according to health notices put in leading dailies⁸.

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