食物安全焦點
Food Safety Focus

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Centre for Food Safety

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在食物中濫用硼酸及硼砂
Abuse of Boric Acid and Borax in Foods

食物安全中心
風險評估組
科學主任陳家茵女士報告

Reported by Ms. Michelle CHAN, Scientific Officer,
Risk Assessment Section,
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食物安全中心(中心)在二零一七年四月及五月公布有關粽子的食物監察結果，顯示兩個散裝鹼水粽樣本含有非准許防腐劑硼酸，含量分別為百萬分之五百及三百五十。本文旨在探討有關在食物中使用硼酸及硼砂的情況、安全及規管事宜。

硼酸及硼砂的使用情況

硼酸及硼砂是含硼化合物。硼酸及硼砂廣泛用於不同消費品，例如洗滌劑、黏合劑及肥料等。早於一八七零年代，在各國因硼酸及硼砂具毒性而開始立法禁止用作食物添加劑前，硼酸及硼砂被添加在食物中用作防腐劑，以抑制微生物(特別是酵母菌)生長，而對霉菌及細菌亦有輕微抑制作用。

在過去多年，香港及其他地方(例如中國內地、台灣及馬來西亞)曾發生在食物中濫用硼砂或硼酸的個案，涉及的食物包括粽子、肉丸、油麵、清心丸及油條等。在食物中非法添加硼酸及硼砂，目的不僅是為了延長食品的保質期，亦因為這些化學品可能令食品更有彈性和更加鬆脆。

在亞洲曾發生濫用硼酸及硼砂的食物例子。
Some food examples have been reported of abusing of boric acid and borax in Asia.

對公共健康的影響

硼可天然存在於某些食物中，例如水果及蔬菜。世界衞生組織(世衞)估計，人們每天平均的硼攝入量完全在世衞建議的人類攝入量的安全範圍之內。在一九六一年，糧農組織/世衞組織食品添加劑專家聯合委員會評估硼酸及硼砂的食用安全問題，結論認為這些化合物不適宜用作食物添加劑。

人類在短時間攝入大量硼酸則會損害胃部、腸道、肝臟、腎臟及腦部，甚或引致死亡。有動物研究顯示，長時

The Centre for Food Safety (CFS) released the surveillance results on rice dumplings in April and May 2017. Two loose-packed "gan shui" (lye water) rice dumpling samples were found to contain boric acid, a non-permitted preservative, at levels of 500 ppm and 350 ppm respectively. This article discusses the uses, safety and regulatory control of boric acid and borax in foods.

Uses of Boric Acid and Borax

Both boric acid and borax are boron-containing compounds. Boric acid and borax are used in a wide variety of consumer products such as detergents, adhesives, fertilisers, etc. As early as 1870s, before countries began legislating against their application as food additives due to their toxicities, boric acid and borax were added to foods as preservatives which inhibit the growth of microorganisms, in particular yeasts, and to a much lesser extent, against moulds and bacteria.

In past years, cases regarding the abuse of borax or boric acid in foods including rice dumplings, meat balls, yellow noodles, root starch jelly and fried fritters were reported in Hong Kong and other places such as Mainland China, Taiwan and Malaysia. These chemicals were illegally added in foods not only for the sake of extending the products' shelf life, but also because they may increase the elasticity and crispiness of foods.

Public Health Significance

Boron can naturally present in certain foods such as fruits and vegetables. The World Health Organization (WHO) has estimated that the average daily boron intake of the population is well within WHO's suggested safe range of population intake. The Joint FAO/WHO Expert Committee on Food Additives evaluated the safety of boric acid and borax in 1961 and concluded that these compounds were considered not suitable for use as food additives.

Consuming large amounts of boric acid over a short period of time can adversely affect the stomach, bowels, liver, kidney and brain, and may even lead to death. Animal studies revealed that prolonged excessive ingestion of

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間攝入大量硼酸會令動物的發育及生殖能力受影響。這些實驗動物不但有睪丸病變及出現不育情況，發育方面也受影響，包括動物胎兒的體重下降，其眼睛、中樞神經系統、心血管系統及骨骼亦出現畸形。目前並無科學證據顯示硼酸對基因有害或會致癌。

規管情況

有關使用硼酸及硼砂的條文並未納入食品法典委員會的標準。此外，硼酸及硼砂亦未有納入中國內地、美國、加拿大、澳洲及新西蘭等地方就准許在食物中使用的添加劑所訂定的名單內。不過，歐洲聯盟例外地准許在魚子醬加入硼酸及硼砂作防腐劑用途。

在香港，根據《食物內防腐劑規例》(第132BD章)，硼酸及硼砂並非准許防腐劑。

本地監察情況

過去，中心一直有監察在不同食物(包括粽子)非法添加硼酸及硼砂的情況。在二零一四年一月至二零一七年五月，中心共抽取727個食物樣本進行檢測，其中三個樣本(全是粽子)檢出含有硼酸。

用於食物的硼酸及硼砂替代品

事實上，在食物中添加硼酸及硼砂，並無必要。人們可採用適當的食品加工處理方法或在有需要時，按《優良製造規範》使用替代品，以取代使用硼酸及硼砂。舉例來說，快速冷凍粽子以延長其保質期，或在製作麵條及加工肉製品時，使用適量的磷酸鹽作為水分保持劑及穩定劑，以改善食品質感。有文獻載明，在製作鹼水粽時加入聚磷酸鹽，有助令粽子更具彈性及減低米粒與粽葉之間的黏著程度。

注意要點

1. 在香港，硼酸及硼砂並非准許防腐劑。
2. 有動物研究顯示，長時間攝入大量硼酸或會令動物的發育及生殖能力受影響。
3. 有其他替代品可取代硼酸及硼砂用於製作食品。

給市民的建議

- 向可靠的零售店鋪購買食物。
- 切勿在自行製作食物時使用硼酸或硼砂。
- 適量進食多種類的食物，避免因偏食幾類食品而攝入過量化學品。

給業界的建議

- 向可靠的供應商購買食物及配料。
- 切勿在製作食品時使用硼酸或硼砂。採用適當的食物加工處理方法，或在有需要時，使用替代品代替使用硼酸或硼砂。
- 確保所出售的食物符合本港規例要求，並須按《優良製造規範》製作食品。

boric acid resulted in adverse developmental and reproductive effects. Among these experimental animals, testicular lesions and impaired fertility had been observed whereas adverse effects on development including decreased foetal body weights, malformations of eyes, central nervous system, cardiovascular system and the skeleton were also demonstrated. Currently, there is no scientific evidence suggesting boric acid is toxic to genes or cancer causing.

Regulatory Control

Provisions for the use of boric acid and borax have not been included in Codex standards. Also, they are not included in the list of additive permitted for use in food in places such as Mainland China, the United States, Canada, Australia and New Zealand. Nevertheless, they are exceptionally authorised in the European Union for use as preservatives in caviar.

In Hong Kong, boric acid and borax are not permitted preservatives under the Preservatives in Food Regulation (Cap.132 BD).

Local Surveillance

Over the past years, the CFS has been monitoring the illegal use of boric acid and borax in different foods including rice dumplings. From January 2014 to May 2017, 727 food samples were collected in which three of them, all as rice dumplings, were detected with boric acid.

Alternatives to Boric Acid and Borax in Foods

In fact, the addition of boric acid and borax in foods is not essential. It can be replaced by adoption of appropriate food processing methods or, if necessary, use of alternatives in accordance to Good Manufacturing Practice (GMP). Examples include quick freezing of rice dumplings to extend shelf life or use of moderate amount of phosphates as humectant and stabiliser in preparing noodles and processed meat products to improve their texture. It is reported in the literature that polyphosphates applied during the preparation of lye water rice dumplings may help enhance elasticity of the dumplings and reduce the adhesiveness between the rice and wrapping leaves.

Key Points to Note

1. Boric acid and borax are non-permitted preservatives in Hong Kong.
2. Animal studies indicated that prolonged excessive ingestion of boric acid may cause adverse developmental and reproductive effects.
3. Alternatives to boric acid and borax are available for preparing foods.

Advice to Public

- Purchase foods from reliable retail outlets.
- Do not use boric acid or borax when making foods on your own.
- Eat a variety of foods in moderation to avoid excessive exposure to chemicals from a small range of food items.

Advice to Trade

- Purchase food and food ingredients from reliable suppliers.
- Do not use boric acid or borax when preparing foods. Replace with alternatives, as necessary, or adopt appropriate food processing methods.
- Make sure food for sale complies with local regulatory requirements and adhere to GMP in food preparation.

食物安全平台
Food Safety Platform

金屬污染物：概覽
Metallic Contaminants: An Overview

食物安全中心
風險評估組
科學主任馬嘉明女士報告

Reported by Ms. Janny MA, Scientific Officer,
Risk Assessment Section,
Centre for Food Safety

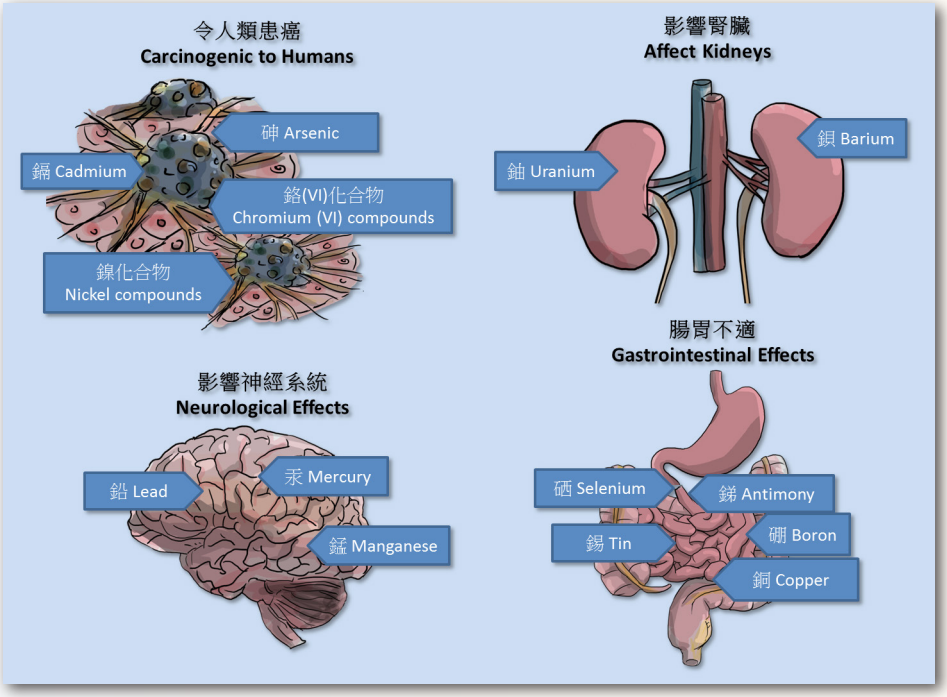
金屬是地殼表面的天然成分，普遍存在於環境中。就銅、鉻、錳及硒等部分金屬而言，我們需要微量該等金屬以供身體正常運作，但過量攝入或會導致不良影響。不過，部分其他金屬(例如砷、鎘及鉛)對人體毫無功能，而且會造成有害影響。鑑於金屬可透過環境污染或在食物製作過程中進入食物，我們將於這新系列主題的文章中，深入探討食物中可能含有的金屬污染物。

對健康造成的不良影響

攝入金屬污染物可能對健康造成不同及多種不良影響。國際癌症研究機構把砷、鎘、鉻(VI)及鎳化合物列為令人類患癌的物質(第1組)。眾所周知，鉛及汞對神經系統有害，而過量攝入錳亦可能影響神經系統。對人類而言，腎炎是鈾金屬所誘發的主要化學反應，而腎臟亦是實驗動物在攝入鋇後受影響的組織。至於其他金屬污染物，例如銻、硼、銅、硒及錫，過量攝入亦可能造成腸胃不適。

值得注意的是，金屬污染物的一些化學形態(例如無機砷及甲基汞)的毒性高於其他化學形態(例如有機砷及無機汞)，而進食含金屬污染物的食物所涉及的風險亦視乎金屬污染物在食物中的含量、進食受污染食物的分量、攝入期長短等因素而定。有些個別群組(例如嬰兒及幼兒)特別易受某些金屬(例如鉛及汞)的不良影響。

食物安全中心先前進行的研究顯示，在香港，育齡婦女從膳食中攝入甲基汞是值得關注的公共衛生問題。



不同金屬污染物可能對人類及／或實驗動物造成一些不良健康影響（未必是毒理學的最終關注重點，且不限於任何特定攝入途徑或攝入期長短)的例子。
[註:上圖僅供參考之用，其內並無詳盡載錄各金屬污染物對健康造成的所有不良影響。]

Examples of some adverse health effects (may not be the toxicological end-point of concern and not limited to any specific route or duration of exposure) which may be caused by different metallic contaminants in humans and/or laboratory animals.
[Note: Above graphic is for illustration purposes only and the adverse health effects mentioned for each metallic contaminant are neither comprehensive nor exhaustive.]

預防及控制

在這現代化的工業世界，大部分涉及食物含金屬污染物的個案均屬無可避免。為保障公眾健康，食物中的金屬污染物含量應通過《優良務

Metals are natural components of the earth's crust and ubiquitous in the environment. For some metals such as copper, chromium, manganese and selenium, we need them in trace amount for normal body function but they may cause adverse effects upon excessive exposure. However, some other metals such as arsenic, cadmium and lead serve no functional purpose but can lead to deleterious effects in our body. As metals can enter our food as a result of environmental contamination or during food production process, let's take a closer look on the metallic contaminants which may be present in our food in this new series of articles.

Adverse Health Effects

Exposures to metallic contaminants may lead to various and multiple adverse health effects. The International Agency for Research on Cancer has classified arsenic, cadmium, chromium (VI) and nickel compounds as human carcinogens (Group 1). Lead and mercury are well-known for their toxicities on the nervous system; high levels of manganese exposure may affect the nervous system as well. While the primary chemically induced effect of uranium in humans is kidney inflammation, the target tissues for barium exposure in laboratory animals also appear to be kidneys. Some other metallic contaminants such as antimony, boron, copper, selenium and tin may also cause gastrointestinal effects upon excessive exposures.

While it is worth noting that certain chemical forms of the metallic contaminants (e.g. inorganic arsenic and methylmercury) are more toxic than the others (e.g. organic arsenic and inorganic mercury); the risk associated with the consumption of food containing metallic contaminants would also depend on their level present in the food, the amount of contaminated food that is consumed as well as the duration of exposure. Some individual subgroups, e.g. infants and young children, are particularly vulnerable to the adverse effects of certain metals, e.g. lead and mercury.

Previous studies conducted by the Centre for Food Safety showed that there is public health concern for dietary exposure of methylmercury for women of child-bearing age in Hong Kong.

Prevention and Control

In this modern industrial world, the presence of metallic contaminants in our food is in most cases unavoidable. To protect public health, levels of metallic contaminants in food should be as low as reasonably achievable

農規範》及《優良製造規範》等良好作業規範，控制在可合理做到的盡可能低水平(ALARA)。

總的來說，從消費者的角度，我們可以做到的是保持均衡飲食，避免因偏吃某幾類食物而過量攝入金屬污染物。

待續…

我們將會在下期集中探討一些被識別為引起重大公共衞生關注的金屬，包括這些金屬對健康造成不良影響的詳情和減少在膳食中攝入這些金屬的方法。

(ALARA) through best practice such as Good Agricultural Practice (GAP) and Good Manufacturing Practice (GMP).

In general, from the consumers' perspective, what we can do is to maintain a balanced diet so as to avoid excessive exposure to metallic contaminants from a small range of food items.

To Be Continued...

In next article, we will focus on some metals that are identified as of major public health concern, including details of their adverse health effects and ways to reduce their exposure in our diet.

食物事故點滴 Food Incident Highlight

老虎斑中的硝基呋喃

上月，食物安全中心(中心)在一個冰鮮老虎斑樣本中檢出微量(十億分之一點六)呋喃唑酮代謝物。呋喃唑酮為其中一種硝基呋喃類禁用獸藥。

硝基呋喃是一類化學化合物，有廣泛抗菌性。食物中含硝基呋喃的主要問題是該等化合物或會令實驗動物患癌。基於現有的科學資料，某些硝基呋喃(包括呋喃唑酮及呋喃西林或其代謝物)在食物中的殘餘並沒有一個安全水平能顯示食用風險可予接受。因此，食品法典委員會建議主管當局應防止食物含有呋喃唑酮及呋喃西林及其代謝物的殘餘。這可以從不對食用動物使用呋喃唑酮及呋喃西林達致。

中心已知會涉事商戶有關的違規情況。根據該商戶所提供的資料，受影響批次已沒有存貨。

Nitrofurans in Tiger Grouper

Last month, the Centre for Food Safety (CFS) found a trace amount (1.6 parts per billion) of metabolite of furazolidone, AOZ, in a chilled tiger grouper sample. Furazolidone, a non-permitted veterinary drug, is a type of nitrofurans.

Nitrofurans are a family of chemical compounds which have broad-spectrum antimicrobial activities. The main concern of nitrofurans in food is that these compounds may cause cancer in experimental animals. Based on available scientific information, there is no safe level of residues of certain nitrofurans, including furazolidone and nitrofural (also known as nitrofurazone) or their metabolites in food that represents an acceptable risk to consumers. For this reason, Codex recommended that competent authorities should prevent residues of furazolidone and nitrofural and their metabolites in food. This can be accomplished by not using furazolidone and nitrofural in food producing animals.

The CFS has informed the vendor concerned of the irregularity. According to the information provided by the vendor, there was no remaining stock of the affected batch.

蘆筍及百合中的鎘

上月，食物安全中心透過恒常食物監察計劃，檢出一個鮮蘆筍樣本(每公斤0.21毫克)及一個乾百合樣本(每公斤0.45毫克)含有金屬污染物鎘，含量超出《食物攙雜(金屬雜質含量)規例》(第132V章)訂明的法定上限。

鎘是天然存在於地殼表面的金屬元素。農作物(包括蘆筍、百合、菇類、稻米及米製品)如生長在受鎘污染的土壤中、以受鎘污染的水澆灌或施用了含鎘的肥料，其鎘含量可能較高。雖然從膳食中攝入鎘導致急性中毒的機會微乎其微，但長期攝入過量的鎘可能會損害腎臟及骨骼。消費者應保持均衡飲食，避免因偏食某幾類食品而大量攝入某些化學品或污染物。

Cadmium in Asparagus and Lily Bulb

Last month, the Centre for Food Safety's routine Food Surveillance Programme detected cadmium, a metallic contaminant, in a fresh asparagus sample (0.21 mg/kg) and a dried lily bulb sample (0.45 mg/kg), at levels exceeded the legal limits stipulated in the Food Adulteration (Metallic Contamination) Regulations (Cap 132V).

Cadmium is a naturally occurring metallic element in the Earth's crust. Crops (e.g. asparagus, lily bulb, mushrooms, rice and rice products) grown in cadmium-contaminated soil, irrigated with cadmium-contaminated water or applied with cadmium-containing fertilisers may have increased concentrations of cadmium. Acute toxicity of cadmium due to dietary exposure is very unlikely but prolonged excessive intake of cadmium may have adverse effects on the kidneys and bones. Consumers are advised to take a balanced diet so as to avoid excessive exposure to certain chemicals or contaminants from a small range of food items.

風險傳達工作一覽 Summary of Risk Communication Work

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