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## 焦點個案 Incident in Focus

## 食物中的砷 Arsenic in Food

食物安全中心  
風險評估組研究主任  
陳蓉蓉女士報告

Reported by Ms. Melva Chen, Research Officer,  
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### 事故摘要

消費者委員會在上月報告，二十多個測試的魷魚乾零食樣本含有砷，當中一個魷魚絲樣本砷含量尤高，過量攝入(例如長期持續每周吃三包或以上有關魷魚絲)可能對健康造成潛在影響。有關結果引起市民廣泛關注食物中砷的風險。此外，其他食品亦可能出現砷含量偏高的情況。較早前，美國及加拿大有部分樽裝礦泉水因砷含量偏高而須在全國進行回收。本文將會詳述與砷有關的食物安全問題。

### Summary of Incident

Last month, the Consumer Council reported that some 20 samples of dried squid snacks under testing contained arsenic. The level of arsenic was particularly high in one shredded squid sample. Excessive intake, like constantly consuming three or more packs of the dried squid concerned every week for a prolonged period of time, may pose possible health risk. The findings aroused much public concern on the risk of arsenic in food. High levels of arsenic may also be found in other food products. Not long ago, there were nation-wide recalls of some bottled mineral water in the United States and Canada due to the presence of high levels of arsenic. This article provides you with more information on food safety in relation to arsenic.



插圖：魷魚乾零食  
Illustration: Dried squid snacks

### 什麼是砷？

砷是蘊藏於地殼的天然準金屬，石頭、土壤、水和空氣都含有微量的砷。人們主要從食物(尤其是砷含量較高的水產)攝入砷。至於透過吸入空氣和皮膚吸收等其他途徑攝入砷，則只佔較小甚或微不足道的比重。

### What is Arsenic?

Arsenic is a metalloid present naturally in the earth's crust and is found in trace amounts in rock, soil, water and air. Primary route of human exposure to arsenic is mainly through ingestion of foods, especially aquatic foods containing relatively high levels of arsenic. Other routes of exposure such as through inhalation of air and via dermal absorption only play a minor or negligible role.

### How Does Arsenic Go Into Our Foods and Affect Our Health?

Arsenic is widely distributed in nature and most arsenic compounds can dissolve in water and result in entering our food chain. Therefore, low levels of arsenic may be found in a wide range of foods. Arsenic exists in both organic and inorganic forms in foods, with the latter being more toxic. Fish and seafood can accumulate considerable amounts of organic arsenic from their environment, while the arsenic content of plants is usually determined by the arsenic content of soil, water, air, fertilisers, etc. In general, arsenic in food exists largely in its organic form and high levels of inorganic arsenic are not commonly found.

### 砷如何進入食物中並影響我們的健康？

由於砷在大自然中普遍存在，加上大部分砷化合物可溶於水中，從而進入我們的食物鏈內，因此許多種類的食物都可能含有小量砷。砷會以有機和無機兩種形態存在於食物中，以後者毒性較強。魚類及海產會在體內大量囤積從環境中攝取的砷。至於植物的砷含量，則通常取決於土壤、水、空氣和肥料等的砷含量。一般而言，食品中的砷主要以有機形態存在，而無機砷含量偏高的情況則較少見。

Chronic toxicity due to arsenic may lead to skin lesions, nerve damage, skin cancer and diseases of the blood vessels. The International Agency for Research on Cancer under the World Health Organization has classified arsenic in drinking water as carcinogenic to humans.

### What Kinds of Food Contribute Most to Our Arsenic Intake?

As a means to assess the intake of metallic contaminants including arsenic in Hong Kong people, the CFS has conducted a risk assessment study on "Dietary Exposure to Heavy Metals of Secondary School Students" in 2002. According to the study, seafood other than fish made the greatest contribution (51%) to dietary exposure to inorganic arsenic, which was followed by fish (26%), cereals and cereal products (10%), vegetables (6%), meat, poultry and their products (4%), and milk and dairy products (3%). These findings were consistent with data in dietary exposure studies conducted in overseas

慢性砷中毒會引致皮膚損傷、神經受損、皮膚癌及血管病變。世界衛生組織屬下國際癌症研究機構已把飲用水中的砷列為會令人患癌症的物質。



## 我們主要會從哪類食物中攝取到砷？

為評估本港市民的重金屬(包括砷)攝取量，食物安全中心(中心)在二零零二年進行了有關《中學生從食物攝取到重金屬的情況》的風險評估研究。根據該項研究，魚類以外的海產是我們攝取無機砷的最主要來源(51%)，其次依序為魚類(26%)；穀類及其製品(10%)；蔬菜(6%)；肉類、禽類及其製品(4%)和奶類及奶製品(3%)。上述結果與澳洲、美國及英國等外國進行有關從食物中攝取砷的研究所得數據一致，即海產是人們攝取砷的最主要食物來源。

## 現時有沒有就砷的安全食用水平制定安全參考值？

聯合國糧食及農業組織/世界衛生組織聯合食物添加劑專家委員會已對砷進行評估，並就無機砷的暫定每周可容忍攝入量定為每公斤人體體重每周可攝入15微克。暫定每周可容忍攝入量，指人一生中可攝入某一污染物而不致帶來可見風險的估計分量。攝入量超出暫定每周可容忍攝入量並不一定表示健康會受損。由於暫定每周可容忍攝入量着眼於人一生的攝入量，只要平均攝入量並非長期超出這一數值，偶然高於暫定每周可容忍攝入量也不會影響健康。

## 如何監察在本港食物中的砷？

中心一向根據食物監察計劃監察食物中的重金屬(包括砷)。食物中准許的砷含量受《食物攪雜(金屬雜質含量)規例》(第132V章)所規管。至於海味等經過乾製過程的食物，污染物濃度會在乾製過程中增加，因此需以“加工系數”確定樣本中驗出的重金屬水平有否超出法定上限。每類乾製食品的加工系數是根據該食品在乾製之前及之後的水分含量變化而釐定。這一做法是由食品法典委員會所建議，現正為歐盟成員國及澳洲等多個國家採用。人們經常會混淆了法例規定的法定上限與上述的安全參考值。法例訂明了不同食物中准許的化學物含量，以便監察及確保食物的標準。進食化學物含量超出法例標準的食物並不表示消費者的健康必定會受損。我們還須考慮有關食物的進食量，以確定有否超出安全參考值。因此，長期過量進食砷含量不高的食物可能損害健康，但偶爾進食高砷含量的食物亦未必會對健康造成影響。

## 砷攝入量超出暫定每周可容忍攝入量的機會高嗎？

上述本港研究發現，攝取量一般的中學生每周從食物攝取的無機砷，按每公斤體重計算為2.52微克，而攝取量高的中學生則為6.77微克，兩者僅為每周可容忍攝入量約17%和45%。此外，攝取量一般的中學生每周從飲用水攝取的無機砷，按每公斤體重計算少於0.13微克，即額外攝入少於0.9%的每周可容忍攝入量。有關結果顯示，在香港從正常飲食中攝入無機砷以致對健康造成不良影響的機會不大。

## 給業界和消費者的建議

業界應確保所出售或進口的食物適宜供人食用，並遵從有關法例標準。至於消費者，則應保持均衡飲食，以免因偏食少種類食物而過量攝入某些化學物或污染物。

countries including Australia, the USA and the UK which reported seafood accounted for the majority of dietary exposure to arsenic.

## Is There Any Safety Reference Value on How Much Arsenic Can be Safely Consumed?

The Joint FAO/WHO Expert Committee on Food Additives (JECFA) has evaluated arsenic and established a provisional tolerable weekly intake (PTWI) of 15 µg/kg bw/week to inorganic arsenic. PTWI is an estimated amount of a contaminant that can be ingested over a lifetime without appreciable risk. An intake above the PTWI does not automatically mean that health is at risk. Transient excursion above the PTWI would have no health consequences provided that the average intake does not continuously exceed the PTWI which emphasises on a lifetime exposure.

## How is Arsenic in Food Monitored in Hong Kong?

The CFS has been monitoring metallic contaminants, including arsenic, in foods under its food surveillance programme. The level of arsenic allowed in food is governed by the Food Adulteration (Metallic Contamination) Regulations, Cap. 132V. As for foods that have undergone a process of drying such as dried seafood, contaminants would have been concentrated during the drying process, therefore “processing factors” need to be applied to see whether the levels of metallic contaminant(s) detected in the samples have exceeded the legal limits. The processing factor for each dried food item is derived based on the change in water content of the food item before and after drying. This approach has been recommended by the Codex Alimentarius Commission and is being adopted by countries including members of the European Union and Australia. Legal limits stipulated in law are often confused with the respective safety reference values. The law states the amounts of chemicals allowed in different foods for monitoring and maintaining the standard of the food. Consuming food products with chemicals exceeding the legal standards does not automatically imply that the consumer's health is at risk. The consumption of the food product concerned also needs to be taken into the account to see whether the safety reference value has been exceeded. Therefore, while indulgence of a food with modest level of arsenic may be a health concern, occasional intake of a food with a high level of such chemical may not be of any health significance.

## How Likely is Our Exposure to Arsenic Exceeds the PTWI?

The local study mentioned above shows that dietary exposure to inorganic arsenic for secondary school students of average consumers is 2.52 µg/kg bw/week and that for the high consumers is 6.77 µg/kg bw/week, which accounted for only about 17% and 45% of the PTWI respectively. Besides, the exposure to inorganic arsenic from drinking water for an average secondary school student was less than 0.13 µg/kg bw/week, an additional contribution of less than 0.9% of the PTWI. The results indicate that adverse health effects due to exposure to inorganic arsenic upon normal consumption of foods in Hong Kong are unlikely.

## Advice to the Trade and Consumers

The trade should ensure the foods they sell or import are fit for human consumption and comply with legal standards. 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

風險傳達工作一覽 (二零零七年四月) Summary of Risk Communication Work (April 2007)	數目 Number
事故/食物安全個案 Incidents / Food Safety Cases	53
公眾查詢 Public Enquiries	182
食物投訴 Food Complaints	475
教育研討會/演講/講座/輔導 Educational Seminars / Lectures / Talks / Counselling	67
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# 食物添加劑 —— 安全與危害

## Food Additives: Safety and Hazards

食物安全中心風險傳達組  
科學主任游天頌先生報告

Reported by Mr. Arthur YAU, Scientific Officer  
Risk Communication Section, Centre for Food Safety



食物添加劑令食物更安全、優質和方便，使我們每天受惠不少。從早餐開始，我們用來炒蛋的油可能含有抗氧化劑，令其不會過早氧化變壞；我們使用的幼鹽含有抗結劑，令其即使在天氣潮濕時仍可自由流動；我們喝的高鈣牛奶飲品含有乳化劑，令當中的乳脂不會分離；麵包含有膨脹劑，令其鬆軟。食物添加劑已成為現代生活中不可或缺的東西。

### 在本港使用的食物添加劑的安全

獲准在本港使用的食物添加劑全部均安全。食物安全中心(中心)在制定本港的食物添加劑安全及規管管制時，已參考國際機關(例如聯合國糧食及農業組織/世界衛生組織聯合食物添加劑專家委員會(專家委員會)和食品法典委員會)的評估工作及建議。專家委員會會根據長期攝入量就食物添加劑的安全性提出建議，再由食品法典委員會這個食物安全國際機關就某類食物中可能使用的食物添加劑提出特定法定水平的建議。另一方面，食物製造商應奉行“優良製造規範”，只使用最低分量的食物添加劑以達至所需的技術效果。

不過，雖然不少食物添加劑已安全使用多年，但我們知道當中有些可能會對某些特定人群的健康造成影響。

### 特定人群及特別添加劑須加倍留意

亞硫酸鹽類的添加劑(和其相關的二氧化硫)常用於餐酒、乾製的蔬菜及水果製品。這類添加劑雖然多年來對大多數人均安全無害，但卻會對亞硫酸鹽類敏感人士造成危害，可能令他們出現哮喘。

天冬酰胺是一種人造甜味劑，由蛋白質中的主要元素氨基酸所製成。這種受歡迎的低熱量甜味劑經常用於汽水和口香糖等食品中。不過，患有苯丙酮酸尿症這種罕見遺傳病的人不能正常分解由天冬酰胺轉化而成的苯丙氨酸，而一般人則可享用這種低熱量甜味劑而不會出現上述問題。因此，苯丙酮酸尿症患者應在飲食中限制進食含苯丙氨酸的食物(包括天冬酰胺和高蛋白質食物)。

硝酸鹽類及亞硝酸鹽類由於能有效對抗肉毒桿菌，並可令醃製肉類呈現特有的粉紅色，故經常在火腿和香腸等醃肉製品中用作防腐劑。不過，大量攝入這兩類添加劑可引致正鐵血紅蛋白血症。這種血液疾病的病徵是呼吸困難及皮膚發紫。因此，應限制其使用量。

### 如何作出精明的選擇？

雖然食物添加劑和現代食品科技為消費者帶來方便安全的食物，但有上述狀況的人或希望避免進食某些食物添加劑的人，應仔細閱讀食物標籤，然後才進食預先包裝食物。例如患

Everyday, we benefit from the safety, quality and convenience brought to us by food additives. Starting from breakfast in the morning, the oil we use to fry our scrambled eggs may contain antioxidants, so that it would not turn rancid easily; the table salt we add contains anti-caking agent, so that it would still flow freely even when the humidity is high; the high-calcium milk we drink contains emulsifier, so that the milk fat would not separate; the bread contains raising agent, so that it is spongy. Food additives become an indispensable part of modern day life.

### Safety of Food Additives Used In Hong Kong

Food additives that are allowed to be used in Hong Kong are safe. The Centre for Food Safety (CFS) has made reference to the evaluations and recommendations of international authorities like the Joint FAO/WHO Expert Committee on Food Additives (JECFA) and the Codex Alimentarius Commission (Codex) when establishing safety and regulatory controls over food additives. JECFA evaluates the safety of food additives based on long term exposure before it makes recommendations. Then Codex, the international food safety authority, recommends specific legal regulatory levels for food additives that may be used in certain types of food. On the other hand, food manufacturers should practice Good Manufacturing Practice and apply food additives in a way that only the minimum amount is added to achieve the desired technological effect.

However, despite the long history of safe use for many food additives, it is well known that certain food additives may cause health concerns in certain groups of people.

### Special Groups, Special Additives Requiring Special Attention

Sulphites, and its related compound sulphur dioxide, are additives commonly used in wines, dried vegetables and fruit products. Despite their long history of safe use to most people, sulphites do pose hazard to people who are allergic to them and may lead to asthma attack in this group of persons.

Aspartame is an artificial sweetener which is produced from amino acids, the building blocks of proteins. This popular low calorie sweetener is often found in products like soft drinks and chewing gums. However, people who suffer from the rare genetic disease phenylketonuria (PKU) cannot properly metabolise phenylalanine, a breakdown product of aspartame, while the general population can enjoy the low calorie sweetener without such problem. Therefore, people with PKU should restrict phenylalanine from all sources, including aspartame and high-protein foods.

Nitrates and nitrites are often added to cured meat products like ham and sausages as preservatives because of their effectiveness against *Clostridium botulinum* and their ability to impart the characteristic reddish-pink colour. However, large dose of the additives may cause methaemoglobinaemia, a disease of the blood characterised by breathlessness and bluish discolouration of skin. Therefore, the usage level should be restricted.

### How to Make a Discerning Choice?

While food additives and modern food technology bring about convenient and safe foods to the consumers, people who suffer from the above mentioned conditions or wish to avoid intake of certain food additives should read the food labels carefully before consuming prepackaged foods. For example, PKU patients should look out for "Sweetener (Aspartame)" or "Sweetener (951)" when purchasing prepackaged foods. The general public should maintain a balanced diet to avoid excessive exposure to additives from a small range of food items.

From 10 July 2007, all prepackaged foods sold in Hong Kong will be required to include the functional classes of food additives and their names or identification numbers in the ingredient list. In



有苯丙氨酸尿症人士，應留意包裝上有沒有列出“甜味劑(天冬酰胺)”或“甜味劑(951)”。至於一般市民，則應保持均衡飲食，以免因偏食少種類食物而攝入過量添加劑。

由二零零七年七月十日起，所有在本港出售的預先包裝食物均須在配料表上標示食物添加劑的作用類別及名稱或其識別編號。為令消費者更加受惠，中心印製了《食物添加劑消費者指南》，讓他們在選購預先包裝食物時可識別各種食物添加劑。《指南》可於衛生教育展覽及資料中心、傳達資源小組及食物環境衛生署轄下各分區辦事處免費索取。此外，亦可於中心網頁下載。

order to maximise the benefits to the consumers, the CFS has prepared a booklet entitled “The Consumer Guide to Food Additives” to help consumers identify food additives when purchasing prepackaged food. The Guide is available for free at [Health Education Exhibition and Resource Centre](#), [Communication Resource Unit](#) and all [district offices](#) of the Food and Environmental Hygiene Department. It is also available for downloading from the [CFS website](#).



插圖：《食物添加劑消費者指南》

Illustration: “The Consumer Guide to Food Additives”



插圖：驗出含高水平麻痺性貝類毒素的扇貝

Illustration: Scallops found to contain high levels of PSP toxins

### 扇貝中的麻痺性貝類毒素

食物安全中心(中心)近日發現，數個蝦夷扇貝樣本含麻痺性貝類毒素，含量為每100克1 120~2 560微克。中心認為有關毒素水平對健康造成影響的風險偏高，故此建議市民暫時停吃扇貝。

麻痺性貝類毒素是可能存在於扇貝、帶子、蠔、青口和蜆等雙貝類體內的天然毒素，由某些品種微藻類所產生，並可積聚在貝類體內，尤其是在藻類大量繁殖的時候。麻痺性貝類中毒症狀通常很快出現，主要與神經系統相關。麻痺性貝類中毒可以致命。

麻痺性貝類毒素在受污染貝類的內臟含量一般較高。烹煮時部分毒素可溶於烹調汁液，而一般烹煮並不能消除這種耐熱的毒素。市民如進食貝類，應在烹煮前先去其內臟、生殖器及卵子，每次進食較少分量，並棄掉烹煮的汁液，以減低貝類中毒的風險。

### Paralytic Shellfish Poisoning Toxins in Scallops

The Centre for Food Safety (CFS) recently found Paralytic Shellfish Poisoning (PSP) toxins in the range of 1 120 to 2 560 micrograms/100 grams in some samples of scallops (*Sin Pui*) of the species *Patinopecten yessoensis*. The CFS considered the health risk associated with these levels of PSP toxins high, and advised members of the public to stop consuming scallops (*Sin Pui*) for the time being.

PSP toxins are a group of natural toxins which can be found in bi-valve shellfish such as scallops, oysters, mussels and clams. The toxins are produced by certain species of micro-algae and can be concentrated within the shellfish, especially during algal blooms. The symptoms of PSP are predominantly neurological and the onset is rapid. PSP can be life-threatening.

The concentration of PSP toxins is generally higher in the viscera of contaminated shellfish. The toxins are heat-stable and cannot be destroyed through normal cooking, although a certain proportion may dissolve into the cooking liquid. Members of the public, when consuming any shellfish, are advised to remove the viscera, gonads and roe before cooking, eat a smaller amount and discard the cooking liquid so as to reduce the risk of shellfish poisoning.

### 肉類製品中的O157:H7型大腸桿菌

肉類製品(尤其是碎牛肉和漢堡牛扒)受O157:H7型大腸桿菌這種有害細菌污染而須回收產品的事件在外國時有發生。

O157:H7型大腸桿菌自然存在於牛隻和豬及羊等其他動物的腸道內。患者可能出現嚴重水狀腹瀉、帶血腹瀉、發燒、腹絞痛或嘔吐等症狀，病情嚴重者可能引致溶血尿毒症，病徵是急性腎衰竭，當中有些患者甚至會死亡。

肉類表面可能會透過屠宰或其後處理過程受O157:H7型大腸桿菌污染。當肉類絞碎再製成漢堡牛扒，又或經捶打變軟時，這些原本沾在肉類表面的細菌便會被帶進肉類的內部。以本港的情況而言，我們的關注是放進熱粥的碎牛肉可能沒有徹底煮熟。

高危人士(即幼童、長者、孕婦和免疫力較弱的人)應避免吃生或未經徹底煮熟的肉類，尤其是碎肉和含碎肉的製品。所有肉類(特別是漢堡牛扒)應徹底煮熟至中心溫度達攝氏75度或以上。

### E. coli O157:H7 in Meat Products

There have been product recalls overseas from time to time regarding meat products (in particular minced beef and beef hamburgers) contaminated with the harmful bacterium *E. coli* O157:H7.

*E. coli* O157:H7 is found naturally in the intestines of cattle and other animals like pigs and sheep. Affected people may develop symptoms like severe watery diarrhoea, bloody diarrhoea, fever, abdominal cramps or vomiting. Severe cases may develop haemolytic uraemic syndrome (HUS) characterised by acute kidney failure, some may even die.

Meat may be contaminated with *E. coli* O157:H7 on the surface from the slaughter process or subsequent handling. When meat is minced and then formed into hamburgers, or is mechanically tenderised, these surface bacteria will be brought into the inner part of the meat. Locally, ground beef served in hot congee which may not be cooked thoroughly is our concern.

Vulnerable groups (i.e. young children, elderly people, pregnant women and persons with weakened immune systems) should avoid eating raw or undercooked meat, especially minced meat and the products thereof. All meat, in particular hamburgers, should be thoroughly cooked to reach a centre temperature of at least 75°C.



插圖：碎牛肉

Illustration: Minced beef