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## 焦點個案 Incident in Focus

## 加工食品中的蠟樣芽孢桿菌

## *Bacillus cereus* in Processed Food

食物安全中心

風險評估組

科學主任莊梓傑博士報告

Reported by Dr. Ken CHONG, Scientific Officer,  
Risk Assessment Section,  
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最近本港發生兩宗預先包裝食物含過量蠟樣芽孢桿菌的事件，受影響的產品包括本地兩間食品連鎖店生產的豆漿和中式湯品。本文將探討加工食品含蠟樣芽孢桿菌的風險及溫度控制的重要性。

### 蠟樣芽孢桿菌及其致病風險

蠟樣芽孢桿菌是一種可產生孢子的細菌，最佳生長溫度約為攝氏30至37度，在攝氏4度以下便會停止生長。蠟樣芽孢桿菌普遍存在於環境和多種食材中，例如蔬果和香草等，但含量一般極低，不至於造成食物中毒。這類食物通常含有每克少於100個孢子，但有些香草及香料可能含有較多孢子。

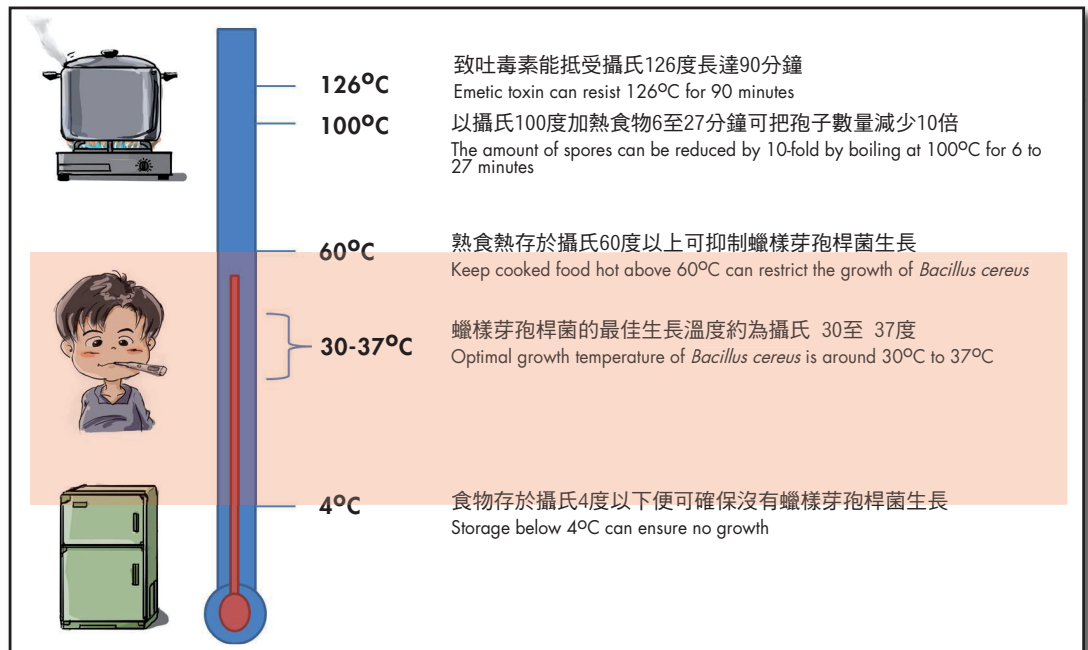
諷刺的是，烹煮過程反而有機會令蠟樣芽孢桿菌大量滋生。正常的烹煮熱力不但不能殺滅孢子，還會誘發孢子萌發，成為繁殖細胞。在其他不耐熱的細菌被熱力消滅的情況下，蠟樣芽孢桿菌的繁殖細胞得以在沒有競爭對手的環境中肆意滋長。烹煮過的食物如放置在室溫下過久，繁殖細胞便會大量生長及／或最終產生致吐(引致嘔吐)毒素。

Recently, there were two incidents involving pre-packaged food products that had been contaminated with excessive amount of *Bacillus cereus*. Affected products included bean milk and Chinese-style soup produced by two local food chains. This article discusses the risk of *Bacillus cereus* in processed food and the importance of temperature control.

### *Bacillus cereus* and its Capability

*Bacillus cereus* is a spore-forming bacterium and grows best at 30°C to 37°C but stops growing at below 4°C. It is commonly found in the environment and a variety of raw foodstuffs such as fruits, vegetables and herbs but the level is generally too low to cause food poisoning. These foods usually contain less than 100 spores per gram, but higher amounts may be found in some herbs and spices.

Cooking, ironically, can give a chance for *Bacillus cereus* to grow into large numbers when opportunity arises. Not only the spores can survive normal cooking temperatures, the heat of cooking also activates the germination of spores of *Bacillus cereus* to become vegetative cells. Cooking also kills other bacteria that are not heat-resistant resulting in an environment short of competitors for the vegetative cells of *Bacillus cereus* to grow. If cooked food is left at ambient temperatures for a prolonged period, the vegetative cells can multiply into large numbers and/or eventually produce emetic (cause vomiting) toxin.



通過控制溫度來抑制蠟樣芽孢桿菌的生長  
Temperature control to restrict the growth of *Bacillus cereus*

焦點個案  
Incident in Focus

這些毒素非常耐熱(能抵受攝氏126度長達90分鐘)，一旦在食物中產生，即使把食物徹底翻熱，也不能將之消除。由這種毒素引起的食物中毒，患者會在進食有問題食物後數小時內出現嘔吐等症狀。這類中毒一般與米製品及其他澱粉質食物有關。

蠟樣芽孢桿菌導致的另一類中毒屬於致腹瀉型，其症狀是伴隨腹痛的水狀腹瀉，因患者吃了含大量蠟樣芽孢桿菌細胞/孢子的食物而令腸毒素在小腸中產生所致。這類中毒一般與肉類、奶類、蔬菜 and 魚類等多種食物有關。

### 控制溫度以抑制蠟樣芽孢桿菌的生長

一般而言，每克食物含有超過10萬個蠟樣芽孢桿菌細胞便有可能引致食物中毒。因此，對付這種頑強的細菌的方法很簡單，就是抑制其生長。而避免蠟樣芽孢桿菌在食物中大量生長及/或產生致吐毒素的關鍵，則是食物在加熱處理後要控制好貯存的時間和溫度。食物在加熱處理後須盡快冷卻並予以冷藏。食物生產商須制定一套標準的冷卻程序及監察貯存情況。另一方面，把煮好的食物保持在攝氏60度以上，亦可抑制細菌滋生。

### 跟進行動

事件經傳媒報道後，食物環境衛生署(食環署)隨即派員到兩間連鎖店的廠房及零售點視察，並抽取樣本作化驗。鑑於有產品檢出過量蠟樣芽孢桿菌，食環署已要求生產商檢討及改善生產流程。食環署會繼續密切跟進事件，並加強監察有關生產商的衛生情況。

### 注意要點

- 蠟樣芽孢桿菌無處不在，多種食物均含有該菌。
- 食物在加熱處理後如貯存不當，會滋生蠟樣芽孢桿菌及產生耐熱毒素。
- 食物加熱處理後盡快冷卻並妥為冷藏可防止該菌大量滋生。

### 給市民的建議

1. 如非即時進食，應把食物貯存於安全溫度(攝氏60度以上/攝氏4度或以下)。
2. 避免把易壞的預先包裝食物和飲品放在室溫下過久；開封或翻熱後應立即食用。

### 給業界的意見

1. 奉行優良製造規範加工處理食品以確保食品不會對公眾構成風險。
2. 食物製造業應採用「食物安全重點控制」(HACCP)系統來管理食物製造過程，藉着應用良好的措施，有系統地防止出現食物安全問題。
3. 食物業界，尤其是食品出產數量龐大的食物製造商應實施預防措施，抑制蠟樣芽孢桿菌在經加熱處理的食物中滋生，例如：
  - 安裝專門的快速冷卻裝置，加快食物的冷卻過程；以及
  - 密切監察雪櫃的溫度，並保存溫度監察的記錄。

Since the toxin is heat-stable (can resist heating at 126°C for 90 minutes), once it is formed, it cannot be destroyed even the food is thoroughly reheated. Food poisoning caused by the toxin is characterised by vomiting within a short period of time after ingestion and has generally been associated with rice products as well as other starchy foods.

On the other hand, the bacterium can cause diarrhoeal type food poisoning which is due to the ingestion of food with large numbers of bacterial cells and/or spores that can produce enterotoxins in the small intestine. Food poisoning of this type is characterised by watery diarrhoea associated with abdominal pain, in which a wide variety of food including meats, milk, vegetables and fish have been implicated.

### Temperature Control to Limit the Growth

In general, the presence of more than 100 000 cells of *Bacillus cereus* per gram of food can cause food poisoning; a simple way to prevent this tenacious bacterium is to limit its growth. Time and temperature control following heat treatment is of prime importance to prevent extensive *Bacillus cereus* growth and/or formation of emetic toxin. A rapid cooling process is required for heat treated food, followed by storage at refrigerator temperature. A set of standard cooling procedures should be established and the storage condition should be monitored. Alternatively, cooked food can be kept at above 60°C to restrict the growth of the bacterium.

### Actions Taken

In response to the media reports, the Food and Environmental Hygiene Department (FEHD) has inspected the processing plants and retail outlets of the manufacturers of the two concerned local food chains and collected food samples for laboratory testing. In view of the excessive amount of *Bacillus cereus* detected in their products, the FEHD has requested the manufacturers concerned to review and improve the production processes. The FEHD will closely monitor the situation and step-up inspection of the manufacturers concerned.

### Key Points to Note

- *Bacillus cereus* is ubiquitous and presents in a variety of foodstuffs.
- Improper storage subsequent to heat treatment can allow the bacterium to grow and form heat-stable toxin.
- Rapid cooling followed by proper refrigeration after heat treatment helps to prevent the multiplication of the bacterium.

### Advice to the Public

1. Keep food at safe temperatures, i.e. above 60°C or at or below 4°C, if it is not consumed immediately.
2. Consume perishable prepackaged food and beverage promptly after opening or reheating and avoid prolonged storage at ambient temperatures.

### Advice to the Trade

1. Observe Good Manufacturing Practice (GMP) in food processing to assure that the food products do not pose risk to the public.
2. Food businesses are recommended to implement the Hazard Analysis and Critical Control Points (HACCP) system, a systematic application of good practice to the prevention of food safety problems.
3. Implement preventive measures, particularly in food businesses with large volume throughput, to restrict the growth of *Bacillus cereus* in heat treated food, for example:
  - install specific rapid chilling equipment to speed up the cooling process, and
  - closely monitor the temperature of refrigerator and maintain a temperature log.



## 食物中的致癌物質

## Carcinogens in Food

食物安全中心  
風險評估組  
科學主任游天頌先生報告

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

我們這三期一直在探討食物、致癌物質與癌症三者之間的關係，本文為該系列之完結篇。

本系列首篇曾提過，我們日常中很多食物都含有致癌物質。雖然把這些致癌物質徹底清除是不可能的，但我們可以通過各種方法把致癌物質減到最少。下文將藉一些常見例子，說明如何減少致癌風險。

### 黃曲霉毒素

食物受黃曲霉毒素污染是全球普遍的現象。據估計，全球達25%的食用農作物受霉菌中的強烈致癌物污染，這種情形在潮濕炎熱的氣候下更加嚴重。我們攝入黃曲霉毒素，主要是因為吃了受污染的食物如粟米、花生、穀物、堅果和乾果等。由於穀類食品受黃曲霉毒素污染的情況在世界各地非常普遍，攝入少量黃曲霉毒素是在所難免的。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（JECFA）建議本着“可合理達到的盡量低原則”，將黃曲霉毒素的攝入量減到最少。這意味着以目前的農耕和生產技術，如要農作物中完全不含或徹底清除這些強烈致癌物，便須面對一大部分農產品被退，無法供應市場的後果。

讓我們以巴西果仁為例，說明“可合理達到的盡量低原則”的作用。據JECFA估計，從理論上來說，假設沒有設立巴西果仁中黃曲霉毒素含量的上限，巴西果仁中黃曲霉毒素的平均含量將為每公斤20微克，國際市場上被退的巴西果仁為零。另一方面，如設上限為每公斤20微克，則平均含量將為每公斤2.4微克，有11%巴西果仁被退；如上限為每公斤4微克，則平均含量將為每公斤1.2微克，有17%巴西果仁被退。

### 砷

砷是一種金屬物質，既是自然存在，亦可由人類活動產生。飲用水和食物是人體攝入砷的主要來源。一般來說，無機砷對人體健康的影響比有機砷大。陸生食物一般砷含量偏低，大米是一個顯著的例外。與其他農作物相比，大米特別容易積聚砷。如土壤本身天然或因污染而含大量砷，在該處種植的大米的砷含量將會更高。有報告指大米的無機砷含量最高可達每公斤510微克，而其他食物的無機砷含量通常不會超過每公斤100微克，平均含量一般少於每公斤30微克。香港首個總膳食研究結果顯示，由於本港市民以米飯為主食，我們難免會從米飯中攝入一些砷。

### 酒精、中式鹹魚和醃製肉類

雖然已知酒精飲品可導致口腔癌、咽癌、喉癌、食道癌、肝癌、大腸癌和女性乳癌等多種癌症，但各地仍有成年人飲用酒精飲品。

中式鹹魚在製作過程中會形成N-亞硝基化合物，我們進食火腿和臘腸等醃製肉類後，體內亦會產生這種致癌物。醃製肉類添加的硝酸鹽除了令肉色鮮艷和提高風味外，還可抑制肉毒桿菌產生毒素。純以含致癌物為由而禁止這些食物是不切實際的。

### 預防癌症 減少從膳食攝入致癌物質

食物中的致癌物質雖然無法根除，但可採用各種方法把危害減到最低。對於不可避免的污染物如黃曲

This is the last of a series of three articles on food, carcinogens and cancer.

As discussed in the first article, carcinogens are present in many commonly consumed foods. With careful handling, carcinogens can be reduced to a low level even though complete elimination may not be possible. Below are some common examples to illustrate how we can reduce the risks.

### Aflatoxins

Aflatoxin contamination of foods is common worldwide. It is estimated that up to 25% of world food crops are affected by these potent carcinogens from moulds especially in hot and humid climate. Exposure to aflatoxins is mainly through consumption of contaminated foods like corn, peanuts, cereals, nuts and dried fruits. As aflatoxin contamination is widespread in cereal staples in many parts of the world, one will inevitably ingest low levels of aflatoxins. The Joint FAO/WHO Expert Committee on Food Additives (JECFA) has recommended that the intake of aflatoxins be reduced to as low as reasonably achievable (ALARA), which means that the current agricultural and manufacturing practices cannot completely prevent or remove these potent carcinogens from crops without rejecting a large portion of the commodities in the food supply.

The concept of ALARA can be illustrated by the Brazil nut example. JECFA has estimated that in theory, if there is no maximum level (ML) for Brazil nuts, the mean aflatoxins level would be 20 µg/kg with no rejection of Brazil nuts from the world market. However, with an ML of 20 µg/kg, the mean level would be 2.4 µg/kg with 11% rejection, whereas an ML of 4 µg/kg would result in 1.2 µg/kg mean level with 17% rejection.

### Arsenic

Arsenic is a metal that exists both naturally and as a result of human activities, and its exposure is mainly through drinking water and food. Its inorganic forms are generally more of health concerns to humans than the organic forms. The arsenic level in food that originated from land is generally low with a notable exception: rice, which is particularly capable of accumulating arsenic from the soil and environment when compared with other crops. The arsenic level would be even higher when the soil is naturally high in arsenic or through contamination. It was reported that rice can accumulate up to 510 µg/kg of inorganic arsenic, while inorganic arsenic level in other foods do not usually exceed 100 µg/kg with mean value generally less than 30 µg/kg. Since rice is a local staple, it is inevitable that we ingest some arsenic through rice consumption as reported in the [First Hong Kong Total Diet Study](#).

### Alcohol, Chinese-style Salted Fish and Cured Meat Products

Alcoholic drinks are consumed by adults in many societies, even though alcoholic beverages are known to cause human cancers in many sites such as the oral cavity, pharynx, larynx, oesophagus, liver colorectum, and female breast.

N-nitroso compounds are formed during the processing of Chinese-style salted fish and when cured meat products like ham and preserved sausages are consumed. The added nitrate in cured meat can inhibit toxin formation by *Clostridium botulinum* bacteria while imparting the distinctive reddish colour and flavour of cured meats. It is impractical to ban these foods solely because of their carcinogenic components.

### Reduce Cancer Risk by Minimising Exposure to Carcinogens through Foods

Even though it is not possible to completely eliminate all carcinogens from food, there are various approaches in minimising the effect of

霉毒素，國際上普遍秉承“可合理達到的盡量低原則”，針對每種農作物採用最佳的種植方法，並設立相應的黃曲霉毒素含量上限。對於食物添加劑如醃製肉類中的硝酸鹽，則按其達到所需效果的最低分量來制定使用上限。醃製肉類等鹽醃食物，尤其是中式鹹魚的食用量務必適可而止。不要飲用酒精飲品。把致癌污染物合理地減到最低；避免或減少進食含致癌物的食物；以及保持健康生活模式等都是些可行的防癌之道。

carcinogens. For unavoidable contaminants like aflatoxins, the ALARA principle is the internationally accepted approach, taking into account the best practices in production of a particular crop and set a maximum level for the commodity accordingly. For food additives like nitrate in cured meats, maximum levels are set for their use with consideration of the minimum level to achieve the desired effect. Salt preserved foods like cured meat should only be consumed in moderation, especially so for Chinese-style salted fish. Consumption of alcoholic drinks is not recommended. Keeping the carcinogenic contaminants at reasonably low level, avoiding or only consuming in moderation of foods that contain carcinogens and maintaining a healthy lifestyle are among the viable options to reduce cancer risk.

食物事故點滴  
Food Incident Highlight

法國生羊奶芝士受O26:H11型大腸桿菌污染

食物安全中心(中心)在七月中旬接獲世界衛生組織和聯合國糧食及農業組織轄下的國際食品安全當局網絡的通報，指一款生羊奶芝士受O26:H11型大腸桿菌污染，受影響的產品曾於六月十六日由法國進口香港。中心得悉事件後，一方面即時聯絡本港的入口商，指令他們停止供應受影響批次的產品；另一方面發出食物警報，提醒市民切勿食用受影響的產品。

*E. coli* O26:H11 in Raw Goat Milk Cheese from France

In mid-July, the Centre for Food Safety (CFS) received a notification from the International Food Safety Authorities Network (INFOSAN) of the World Health Organization and the Food and Agriculture Organization of the United Nations that a raw goat milk cheese, imported from France on 16 June, was contaminated by *E. coli* O26:H11. The CFS immediately contacted the importers concerned in Hong Kong and instructed them to stop supply of the affected batch of the product. The CFS also issued a food alert warning the public not to consume the affected product.

大腸桿菌是動物和人類腸道中常有的菌叢。大部分大腸桿菌菌株都是非致病性的，但某些則可引致疾病，而O26型大腸桿菌是其中一種可引致嚴重疾病的菌株。

*E. coli* is part of the common flora found in intestines of animals and humans. A majority of its strains are non-pathogenic, whilst some are pathogenic. *E. coli* O26 is one of the strains which can cause serious illness in humans.

市民切勿食用受影響批次的產品。如食用上述產品後感到不適，應盡快求醫。

Consumers should not consume the affected batch of the product concerned. They are advised to seek medical advice if feeling sick after consuming the product concerned.

飲品、甜品和烘焙食品中的糖分

Sugars in Beverages, Desserts and Bakeries

食物安全中心(中心)上月發表了有關本港一些非預先包裝食物的糖含量的研究報告。報告指出某些種類的不含酒精飲品(包括少甜配方)、甜品和烘焙食品的糖含量偏高。

Last month, the Centre for Food Safety (CFS) released the report of its study on sugars content of some non-prepackaged food in Hong Kong. Certain kinds of non-alcoholic beverages (including the less sweet version), dessert and bakery products were found to contain high sugars content.

糖是簡單的碳水化合物，可天然存在或添加於食物和飲品中。進食太多糖可能會攝入過多能量，增加超重和患上肥胖症的風險，以致容易患上心血管疾病、二型糖尿病及某些癌症。此外，經常攝取過量糖分亦會導致蛀牙。



糖分高的食物  
Foods high in sugars

Sugars are simple carbohydrates which can be found naturally or added to foods and beverages. Consuming too much sugars may result in excessive energy intake and increase the risk of overweight and obesity, which may lead to cardiovascular diseases, type-2 diabetes and certain types of cancers. Frequent and excessive intake of sugars can also cause dental caries.

中心會持續監察本港市面上食物的糖含量變化。為減低糖攝入量，市民應保持均衡和多元化的飲食，減少進食添加了大量糖的食物，如冰類飲品、馬卡龍和淨牛油蛋糕等。業界則應參考《降低食物中糖和脂肪含量的業界指引》，生產和推廣既健康又可安全食用的較低糖食物。

The CFS will continuously monitor the changes of sugars content in locally available foods. To reduce the sugars intake of the population, the public is advised to maintain a balanced, varied diet, and to limit the consumption of foods with high amount of added sugars such as icy drinks, macarons and plain cakes. The trade is advised to make reference to the Trade Guidelines for Reducing Sugars and Fats in Foods in producing and promoting wholesome and safe products with lower sugars content.

風險傳達  
工作一覽  
Summary of  
Risk Communication Work

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