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## 蠟樣芽孢桿菌及金黃葡萄球菌產生的耐熱毒素：食物烹煮後不應在室溫下放置過久的原因

### Heat-stable Toxins from *Bacillus cereus* and *Staphylococcus aureus*: Why Cooked Food Should Not Be Left at Room Temperature for Too Long

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, Centre for Food Safety

最近，本地一食肆的炒飯樣本檢出含過量蠟樣芽孢桿菌。在一般情況下，烹煮和翻熱可確保食物安全，但食物烹煮後若處理不當，蠟樣芽孢桿菌及金黃葡萄球菌等細菌便會有機可乘，產生耐熱的毒素，導致食物中毒。現在我們來看看細菌如何在已烹煮的食物中繁殖，以及我們可以如何避免這種情況發生。

Recently, fried rice samples from a local restaurant were found to contain excessive amounts of *Bacillus cereus* (*B. cereus*). While cooking and reheating generally makes foods safe, subsequent improper handling of cooked food may create opportunities for bacteria like *B. cereus* and *Staphylococcus aureus* (*S. aureus*) to form heat-stable toxins, causing food poisoning. Now let us look at how cooked food allows bacteria to thrive and how we can avoid this from happening.

#### 食物烹煮後處理不當存有風險

蠟樣芽孢桿菌及金黃葡萄球菌廣泛存在於環境之中，在食物中的含量通常很低，一般不會引致食物中毒。這些細菌必須生長至很大數量，才能在食物中產生足以致病的毒素。食物烹煮後處理不當，例如長時間貯存在環境溫度下，便會造就細菌滋生的機會。

#### Improper Handling after Cooking Can Put Food at Risk

*B. cereus* and *S. aureus* are widespread in our surroundings and are normally present at low amounts in food, which does not always result in food poisoning. These bacteria have to grow to high levels to produce sufficient toxins in foods to make people sick. Mishandling of food after cooking will create such an opportunity, such as prolonged storage under ambient temperatures.

**正確冷卻熱食的時限**  
Time Limits for Proper Cooling of Hot Food

在冷卻過程中監察時間與溫度  
Monitoring time and temperature during cooling

加快冷卻食物的方法  
(可選用其中一項或以上)  
Options for speeding up cooling of food (can use one or more of these)

- ★ 把食物分成較小份，放在淺容器內  
Divide the food into smaller portions in shallow containers
- ★ 把整碗食物放在冰水中加以攪拌  
Place a bowl of food in an ice-water bath and stir the food
- ★ 把食物攤開在盤中，例如飯  
Spread food out in a tray, e.g. rice
- ★ 如需大規模冷卻，可採用急速冷卻法(如有設備)  
For large-scale cooling, blast chilling may be used if available

迅速地 Quickly

圖1：在烹煮後安全冷卻新鮮製作的食物  
Figure 1: Safe cooling of freshly produced food after cooking

雖然烹煮可以有效殺死金黃葡萄球菌及蠟樣芽孢桿菌的繁殖細胞，但蠟樣芽孢桿菌能以孢子形式存在，這些孢子可抵受正常的烹煮溫度，必須經過高溫處理(例如以攝氏121度加熱3分鐘)才能消滅。然而，烹煮的熱力不僅促使孢子生長成為繁殖細胞，還會殺滅其他競爭的微生物，提供有利繁殖細胞生長的環境。同樣地，如果食物烹煮後受金黃葡萄球菌污染，由於其他微生物已被殺滅，金黃葡萄球菌便可以在食物中大量繁殖。這些細菌在繁殖過程中會產生毒素，翻熱也不能將之消除。因此，食物烹煮後應正確處理，以減少這些細菌產生毒素的風險。

### 避免交叉污染及危險溫度

首先，盡可能減少這些細菌造成污染是十分重要的。保持食物配製區清潔，可防止來自環境的污染，包括蠟樣芽孢桿菌的孢子。在配製食物時，食物處理人員應遵守良好衛生規範，例如經常洗手和隨手清潔食物接觸面。金黃葡萄球菌通常存在於人類的鼻腔、咽喉、頭髮及皮膚。在處理配製好的食物時，可以使用口罩及髮網，以防止來自身體其他部位的金黃葡萄球菌造成污染，同時應使用防水膠布覆蓋手部傷口。

為了避免產生毒素的微生物，尤其是食物中難以有效消滅的蠟樣芽孢桿菌孢子，在烹煮後抑制細菌生長也是非常重要的。新鮮烹製的食物應盡快食用，否則應熱存於攝氏60度以上的溫度，例如預先烹製以供午膳時間出售的炒飯。新鮮製作食物亦可將之冷卻，以供冷食(例如豆漿)或再進行加工(例如降低蒸飯的濕度以製作炒飯)。如進行冷卻，應在兩小時或更短時間內把食物由攝氏60度降溫至攝氏20度，然後在四小時或更短時間內在雪櫃中由攝氏20度降溫至攝氏4度(見圖1)。這些時限有助防止食物長時間放置在環境溫度下，從而防止危險細菌滋生。

如果食物經冷凍後供熱食，應徹底翻熱至中心溫度最少達攝氏75度，但不應翻熱超過一次，以免重複置於危險溫度下。

### 注意事項

1. 烹煮和翻熱把細菌殺死，在一般情況下可確保食物安全，但其後食物若處理和貯存不當，蠟樣芽孢桿菌及金黃葡萄球菌便會有機可乘，產生耐熱的毒素。
2. 烹煮的熱力能誘發蠟樣芽孢桿菌的孢子發芽成為繁殖細胞，還會消滅其他微生物，提供有利繁殖細胞及造成污染的金黃葡萄球菌生長的環境。
3. 食物烹煮後如非立即食用，應放置於攝氏60度以上的溫度，或迅速冷卻，以防止造成污染的細菌滋生。

### 給業界的建議

- 仔細預計需要多少食物，以免過量生產，導致沒有空間妥為熱存、冷卻和冷存食物。
- 預先計劃生產時間，避免過早烹製食物。

### 給市民的建議

- 食物烹煮後應盡快食用。供冷食的食物如非立即食用，應貯存在攝氏4度或以下的雪櫃中。
- 徹底翻熱經冷凍的食物，並且不要翻熱超過一次。

While cooking is effective to kill *S. aureus* and vegetative cells of *B. cereus*, *B. cereus* can exist as spores which are resistant to normal cooking temperature and can only be eliminated by high-temperature treatment, say 121°C for 3 minutes. Paradoxically, the heat from cooking not only makes the spores grow into vegetative cells, but also creates an environment conducive to cell growth by killing off other competing microorganisms. Similarly, *S. aureus*, if contaminating food after cooking, can thrive well in the cooked food in the absence of other microbes. Toxins will be formed during multiplication of these bacteria, which cannot be eliminated by reheating. Hence, food should be handled properly after cooking to reduce the risk of toxin production by these bacteria.

### Avoid Cross-contamination and Dangerous Temperatures

Minimising contamination by these bacteria is crucial in the first place. Clean food preparation areas prevent contamination from the environment, including spores of *B. cereus*. When preparing food, food handlers should ensure good hygiene practices, such as frequent hand washing and cleaning food contact surfaces as they go. *S. aureus* is commonly present in human nasal passage, throat, hair and skin. Masks and hairnets can be used while handling prepared food to prevent *S. aureus* contamination from other body parts, while waterproof adhesive dressings should be applied for covering hand wounds.

Limiting bacterial growth after cooking is also important for avoiding toxin-forming microorganisms, particularly when *B. cereus* spores in food cannot be efficiently eliminated. Freshly prepared food should be eaten as quickly as possible; otherwise, it should be held at temperatures over 60°C for hot holding, such as fried rice prepared ahead of time for sale during lunch hours. Freshly produced food may also be cooled down before serving cold, such as soybean milk, or for additional processing, such as making steamed rice less wet for fried rice. In these instances, cool food from 60°C to 20°C in two hours or less, and then from 20°C to 4°C in four hours or less in a fridge (See Figure 1). These time limits help prevent prolonged exposure to ambient temperature and, therefore, dangerous bacteria growth.

If chilled food is served hot later, it should be reheated thoroughly until the temperature at its centre reaches at least 75°C. However, it should not be reheated for more than once to avoid multiple exposures to dangerous temperatures.

### Key Points to Note

1. Cooking and reheating usually can render food safe by killing bacteria, but subsequent improper handling and storage may also create an opportunity for *B. cereus* and *S. aureus* to form heat-stable toxins.
2. The Heat of cooking can induce the spores of *B. cereus* to germinate and become vegetative cells and creates a favourable environment for the cells as well as contaminating *S. aureus* to grow in the absence of other microbes.
3. Cooked food that are not consumed immediately should be held at temperatures over 60°C or cooled rapidly to prevent the growth of contaminating bacteria.

### Advice to the Trade

- Carefully estimate how much food is required to avoid overproduction leading to running out of room for proper hot-holding, cooling and refrigeration.
- Plan the production schedule ahead to avoid preparing food too far in advance.

### Advice to the Public

- Consume cooked foods as soon as possible. If food served cold is not consumed immediately, keep it in the fridge at 4°C or below.
- Reheat chilled food thoroughly and do not reheat food more than once.

# 食物安全與水浸

## Food Safety and Flooding

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

在夏季及風季，香港不時會出現嚴重而持久的暴雨，部分地點可能會發生水浸。隨著全球出現氣候變化，豪雨、熱帶氣旋及氣溫暖化都是導致水浸更頻繁發生的原因。洪水可污染食物，而惡劣天氣可能會造成局部或廣泛地區停電，導致容易腐壞的食物因冷藏中斷而變壞。為了未雨綢繆，現在正是審視如何做好應急準備和處理善後工作以確保食物安全的好時機。

### 洪水對食物安全的危害

洪水構成潛在的食物安全問題。食物可能會被污水所污染的洪水淹浸，當中可能帶有大腸桿菌、沙門氏菌、甲型肝炎病毒和諾如病毒等致病微生物，以及其他污染物。受潮的食物也容易滋生霉菌。因此，為了確保食物安全，在水浸前後採取適當的預防措施是很重要的。

如果預料會發生水浸，應把食物貯存區及雪櫃置於盡可能遠離洪水的地方。在水浸之後，應確保所有受影響的工作面、用具及廚房設備都已清潔和消毒，才處理食物。如果木砧板及木製用具被洪水浸過，應將之棄掉。

### 水浸後挽救食物

在計劃水浸後如何挽救食物時，重要的是切勿食用任何曾被洪水淹浸但並非以防水容器包裝的食物。只有商業生產的雙縫蓋金屬罐及殺菌軟袋(即以軟箔袋包裝耐於保存的食物。見圖2)才屬防水的食物包裝。棄掉任何包裝有膨脹、滲漏、生鏽或凹陷跡象的損壞食品，然後只要小心處理，便可挽救包裝完好的食品以供食用：首先，清除任何標籤，抹去或刷掉附著的任何污垢或淤泥。用水及肥皂清洗食品的包裝，並徹底沖洗。接下來進行消毒，可把食品浸入乾淨的沸水中兩分鐘。食品消毒後應風乾最少一小時才貯存，並重新標明產品資料，例如產品名稱及食用期限。這些食品亦應標明「先用」，並盡快食用。

所有非預先包裝的食物，以及不屬防水包裝的食物，例如以螺旋蓋、卡扣蓋、易拉蓋或捲邊蓋容器包裝的食物，如果被洪水浸過，都應棄掉。以紙盒、塑膠或布包裝的食物，以及自製瓶裝食物，若曾被洪水淹浸，亦應丟棄。這是因為沒有切實可行的修復或處理方法，可以挽救這些食物。

### 停電時該怎麼辦

暴雨及水浸有時會造成電力供應中斷，導致雪櫃及冰格無法以安全溫度貯存食物。一旦停電，應記下開始的時間。保持

During the summer and typhoon seasons, Hong Kong often experiences severe and protracted rainstorms, where flooding may occur in some locations. With the advent of global climatic change, the combination of heavy rainfall, tropical cyclones and warmer temperatures is a recipe for more frequent flooding. Floodwater can contaminate food, and adverse weather might cause local or widespread power cuts, resulting in spoilage of perishable food due to disruption of refrigeration. While the sun shines, it is a good time to review how to prepare for such emergencies and deal with the fallout relating to food safety.

### Food Safety Hazards of Floodwater

Flooding poses a potential food safety concern. Foods may be inundated in floodwater contaminated with sewage that can carry disease-causing microorganisms such as *E. coli*, *Salmonella*, hepatitis A virus and norovirus, as well as other contaminants. Dampened food is also susceptible to mould growth. Therefore, it is important to take proper precautions before and after a flood to ensure food safety.

If flooding is expected, position food storage areas and refrigerators as far away from floodwater as feasible. After floods, make sure all affected work surfaces, utensils and kitchen equipment are cleaned and disinfected before handling food. If wooden chopping boards and wooden utensils have come into contact with floodwater, dispose of them.

### Food Salvage after Floods

When planning to salvage food after floods, it is important not to eat any food that has been submerged in floodwater and has not been packaged in a waterproof container. Only foods packed commercially in metal cans with double-seamed lids and retort pouches (i.e. shelf-stable food in packaging comprised of a flexible foil laminate. See Figure 2) are regarded as waterproof. After discarding any damaged items that exhibit signs of swelling, leakage, rusting or dents, the intact ones can be salvaged for consumption with careful handling: First, remove any labels and wipe or brush away any dirt or silt attached. Wash the packaging of the food items with water and soap and rinse thoroughly. This is followed by sanitisation, which can be achieved by immersing the items in clean boiling water for two minutes. Allow the sanitised items to air dry for at least one hour before storing, and relabel them with product information such as the product name and expiry date. These items should also be marked 'to be used first' and consumed as soon as possible.

All non-prepackaged foods, as well as those not in a waterproof packaging, such as containers with screw caps, snap lids, pull tops or crimped caps that have come into contact with floodwater should be discarded. Food in paper carton, plastic or cloth packaging, as well as home-canned food, immersed in floodwater should also be tossed away. This is because there are no practical methods of reconditioning or processing to salvage these foods.

### What to Do in Case of a Power Cut

Heavy rainstorms and flooding can occasionally disrupt power supplies, which render refrigerators and freezers incapable of keeping food at safe temperatures. Upon a power cut, take note of when it began. Keeping the refrigerator and freezer doors closed can help maintain a safe storage temperature. When electrical supply is restored, follow the 'two-hour / four-hour principle' for perishable items such as meat,



圖2：被洪水淹浸後可以及不可以保留的食物包裝種類  
Figure 2: Types of food packages that can and cannot be saved after exposure to floodwater

雪櫃及冰格的門關閉，有助維持安全的貯存溫度。當電力供應恢復後，應遵從「兩小時/四小時原則」來處理肉類、海產、蛋類、乳製品及熟食等容易腐壞的食品。當停電超過四小時，切勿以試吃來判斷食物是否安全。如有懷疑，把食物丟掉。

### 食物業的責任

食物業有責任確保食物安全，不應提供被水浸或停電損壞而棄置、變壞或腐爛的食物供人食用。有問題的食品應放在一旁，用垃圾袋裝好，並標明不宜供人食用。食物業必須安全地處置廢棄食品，確保不會被食用。在緊急事故過後，應暫停營業，直至完成徹底清理和消毒，以防止因食物污染或環境不衛生而引致食源性疾病。

seafood, eggs, dairy products and cooked dishes. When the power is off for more than four hours, do not taste the food to determine its safety. If in doubt, toss out the food.

### Roles of Food Businesses

Food businesses have the responsibility of ensuring food safety, and should not supply discarded, spoiled or rotten foods damaged by floods or power cuts for human consumption. Defective food products should be set aside, bagged in refuse sacks and tagged as unfit for human consumption. Food businesses have to safely dispose of condemned food items to ensure that they will not be consumed. After emergencies, business should be suspended until thorough clean-up and disinfection is completed in order to prevent foodborne diseases caused by food contamination or poor environmental hygiene.

## 本港點心的鈉含量 Sodium Content in Dim Sum in Hong Kong

食物安全中心(食安中心)就本地非預先包裝點心的鈉(鹽)含量進行了研究，以監察鈉含量的變化。與上次的研究比較，在十一款點心之中，有九款的鈉含量有所下降，結果令人鼓舞。不過，蝦肉燒賣、蝦肉春卷及蒸牛肉球的鈉含量相對偏高。此外，添加醬料可使鈉含量增加一倍。

從研究所得，同款點心的鈉含量差異頗大，反映點心有減鈉的空間，例如選用鈉含量較低的配料和多使用香料。業界應改良食品配方和分開送上醬料，以進一步降低點心的鈉含量。消費者應保持均衡飲食。在吃點心時，應選擇鈉含量較低的點心，要求把醬料分開送上，並且蘸上少量便可。

The Centre for Food Safety (CFS) has conducted a study on the sodium (salt) content of local non-prepackaged dim sum in order to monitor the changes in levels. It is encouraging that nine out of eleven types of dim sum have sodium levels reduced when compared with the last study. However, the sodium contents of shrimp siu mai, spring roll with shrimp and steamed minced beef ball were relatively high. Furthermore, adding sauces can double the sodium level

A large variation in sodium levels within the same type of dim sum was observed, suggesting room for improvement through choice of ingredients with less sodium and use of more spices. The trade should strive to lower the sodium levels in dim sum further through reformulation and serving sauces separately. Consumers should maintain a balanced diet. When consuming dim sum, choose the ones with lower sodium levels. Request that sauces be served separately and dip sparingly.

## 食油中的污染物 — 如何解讀？ Contaminants in Cooking Oil – How to Interpret?

有本地機構發表報告，指在食油中驗出污染物，這些污染物亦曾在海外研究中發現。

食物安全中心(食安中心)對這些污染物進行了風險評估，結果顯示在正常情況下食用這些食油不會影響健康。風險評估是根據健康參考值進行，該值指在一生中每天攝入某種污染物而不致對健康構成可見風險的估計分量。一般來說，從膳食中攝入低於健康參考值的污染物不會造成健康問題。

在樣本中驗出鄰苯二甲酸酯含量最高的橄欖油，要每天食用3.5瓶(約870毫升)，即一名普通成年人食用量的87倍，才會超過健康參考值。至於含氯丙二醇的椰子油與牛油果油調和油樣本，則要每天食用大概三分之一瓶(約130毫升)，即一名普通成年人食用量的13倍，才會超過健康參考值。

A local organisation reported the detection of some contaminants in cooking oils, which are previously found in overseas studies.

The Centre for Food Safety (CFS) conducted risk assessments of these contaminants and concluded that normal consumption of these cooking oils will not affect health. The risk assessments are based on the Health-based Guidance Values (HBGVs), an estimate of the amount of a contaminant ingested daily over a lifetime without appreciable health risk. In general, dietary exposure to a contaminant below its HBGV will not be a health concern.

For the olive oil sample with the highest level of phthalates reported, a person would need to consume 3.5 bottles of the sample (about 870 millilitres) daily, which is 87 times the amount consumed by an average adult, to exceed the HBGV. For 3-MCPD, it is necessary to consume roughly one-third of a bottle of the relevant coconut and avocado cooking oil blend (about 130 millilitres) daily, which is 13 times the amount consumed by an average adult, to exceed the HBGV.



## 風險傳達工作一覽 (二零二二年七月)

### Summary of Risk Communication Work (July 2022)

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