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## 焦點個案 Incident in Focus

## 食物中的甲醛 Formaldehyde in Food

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,

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### 背景

回應近日市民對九肚魚(一種海魚)含甲醛的關注, 本文概述甲醛這種物質, 並探討其食物安全風險。

### 什麼是甲醛?

甲醛是一種工業化學物, 用以製造可用於木材、紙張和紡織工業的塑膠樹脂, 而福爾馬林則是含有約百分之三十七甲醛的溶液, 能在家庭產品中用作消毒劑和防腐劑。

甲醛由於可透過自然和人工途徑產生, 因此在環境中無處不在。大部分有生命的生物都含有少量在新陳代謝過程中產生的甲醛。甲醛的主要人工產生途徑包括燃燒(例如引擎排氣、焚燒木材、發電廠、焚燒廢物等)、建築物料和吸煙時產生的煙。

除了在工作環境中攝入甲醛外, 一般人主要透過吸入空氣(尤其是室內空氣)攝入甲醛。新的建築物料和家具會釋放出甲醛。此外, 在室內空氣吸入甲醛這途徑中, 吸煙時產生的煙佔百分之十至百分之二十五(每日0.1毫克至1毫克)。至於透過氣體和皮膚接觸而攝入甲醛的其他途徑, 還有煙霧、氣體煮食爐、露天火爐、木製品、紡織品、紙張、化妝品和藥物等。

甲醛存在於多種動物和植物身上, 屬於正常新陳代謝過程中的產物。吃下少量甲醛不會造成急性中毒, 但吃下大量甲醛則通常會引致嚴重腹痛、嘔吐、昏迷、腎臟受損或死亡。不過, 根據世界衛生組織的報告, “一般人主要透過吸入攝入甲醛”。

甲醛對人類健康的主要關注是其會否致癌。世界衛生組織下的國際癌症研究機構把甲醛列為“會令人患癌”, 認為有充分證據證明這物質可令人患鼻咽癌, 並有有力但不充分的證據證明白血病與在工作環境中攝入甲醛有關。另一方面, 世界衛生組織認為有關證據顯示透過進食而攝入的甲醛不會致癌。

### 為什麼食物含有甲醛?

甲醛是正常新陳代謝過程中的產物, 有不同文獻記載這物質自然存在於許多常見食品(包括水果、蔬菜、肉類、魚類、甲殼類動物和乾冬菇等), 但含量(見表一)各異。在部分海產中, 甲醛是其體內一種名為“氧化三甲胺”的化學物自然分解出來的產物。氧化三甲胺在動物死後會分解為數量相同的甲醛和二甲胺。甲醛會在某些海魚冷藏過程中和甲殼類動物死後累積。有研究稱九肚魚在冷藏後甲醛含量可達每公斤400毫克。我們利用九肚魚化驗出的二甲胺含量以分辨甲醛曾否被刻意添加。

### Background

In the wake of recent public concerns over formaldehyde found in Bombay-duck (a kind of marine fish), this article provides an overview on formaldehyde and discusses its food safety risk.

### What is Formaldehyde?

Formaldehyde is a chemical commonly used in industry for the manufacturing of plastic resins that can be used in wood, paper and textile industry. Formalin, which is a solution of about 37% formaldehyde, serves as disinfectant and preservative for household products.

Formaldehyde is ubiquitous in the environment, as it is produced from both natural and man-made sources. It exists at low levels in most living organisms as a metabolic intermediate. Major man-made source of formaldehyde includes combustions (e.g., engine exhaust, wood burning, power plant, waste incineration etc.), building materials and tobacco smoke.

Excluding occupational exposure in industrial settings, major exposure route for formaldehyde in the general population is through inhalation of air, especially indoor air. Formaldehyde can come from recently installed building materials and furnishings. Tobacco smoke can also contribute up to 10 to 25 percent (0.1-1 mg/day) of the exposure from indoor air. Other sources of exposure through gas and dermal contact in the general population include: smog, gas cookers, open fireplace, wood products, textiles, paper, cosmetics and pharmaceuticals etc.

Formaldehyde exists in many animal and plant species as a product of their normal metabolism. Ingestion of a small amount of formaldehyde is unlikely to cause acute effect, but ingestion of a large amount of formaldehyde can generally cause severe abdominal pain, vomiting, coma, renal injury and possible death. However, according to the World Health Organization (WHO), “the general population is exposed to formaldehyde mainly by inhalation.”

The main health concern of formaldehyde is its cancer causing ability. The International Agency for Research on Cancer of the WHO classified formaldehyde as “carcinogenic to humans”, with consideration that there was sufficient evidence for causing nasopharyngeal cancer in humans, strong but not sufficient evidence between leukaemia and occupational exposure. The WHO, on the other hand, considered that the evidence indicated that **formaldehyde was not carcinogenic upon ingestion.**

表一：食物中天然含有甲醛的例子

Table 1: Examples of Foods Known to Contain Naturally Occurring Formaldehyde

食物種類 Food Type		含量(毫克/公斤) Level (mg/kg)
水果及蔬菜 Fruits and Vegetables	蘋果 Apple	6.3-22.3
	香蕉 Banana	16.3
	椰菜花 Cauliflower	26.9
	梨 Pear	38.7-60
	冬菇(乾/新鮮) Shiitake mushroom (dried / raw)	100-406 / 6-54.4
肉類及肉類製品 Meat and Meat Products	牛肉、豬肉、羊肉及禽肉 Beef, pork, mutton and poultry meat	2.5-20
	海鮮 Seafood	
	鱈魚 Cod	4.6-34
	魚蛋 Fish ball	6.8
	甲殼類動物 Crustacean	1-98
	九肚魚(新鮮) Bombay-duck (fresh)	≤140



插圖：食物中天然含有甲醛的例子（上圖：鮮冬菇，下圖：九肚魚）

Illustration: Examples of food which contain naturally occurring formaldehyde. (Above: fresh shiitake mushrooms. Below: Bombay-duck)



由於有關食物中自然存在甲醛含量的研究不多，因此未必每種食物都可提供相關數據。以往曾有報道指粉絲、腐竹和發水食品(例如牛柏葉)濫用甲醛。在二零零四年至二零零六年九月，在250多個進行甲醛化驗的食物樣本中，結果全部滿意。市民只要保持均衡飲食，便無須過分擔心從食物中攝入甲醛。

由於甲醛可溶於水中，因此減低風險之道是在配製期間徹底浸泡乾製食品，並把用作浸泡的水棄掉。此外，另一預防措施是徹底清洗和煮熟所有食物方才進食。

### 給消費者的建議

1. 由於甲醛可溶於水中，而清洗有助去除甲醛，因此應以流動自來水徹底清洗所有食物。
2. 乾冬菇等乾貨應在烹煮前以乾淨清水徹底浸泡，並將清水棄掉。
3. 由於烹煮產生的熱力有助去除甲醛，因此應徹底煮熟食物至中心溫度達攝氏75度或以上。至於魚類，可查看魚肉是否已煮熟至不再透明及容易分開。

### 給業界的建議

1. 從可靠的商號採購食品。
2. 切勿在食物內添加甲醛。

### 更多資料

如欲獲得更多資料，請瀏覽下列網頁：

- [中心發出的新聞公報](#)
- [中心發出的食物警報](#)
- [中心編製有關食物中含甲醛的風險簡訊](#)

## Why Formaldehyde is Present in Food?

As a product of normal metabolism, formaldehyde has been documented to be naturally present in many common food items, including fruits and vegetables, meats, fish, crustacea and dried mushrooms etc., at a wide range of levels (Table 1). In some seafood species, formaldehyde is a natural breakdown product of a chemical known as trimethylamine oxide (TMAO) that exists in their bodies. Trimethylamine oxide breaks down into formaldehyde and dimethylamine in equal parts after the animal dies. The level of formaldehyde can accumulate in certain marine fish during frozen storage and crustacea after death. Its levels were reported to be up to 400 mg/kg in Bombay-duck after cold storage. The detection of dimethylamine in Bombay-duck was used to distinguish whether formaldehyde had been added deliberately.

Since there have been no extensive studies on the levels of naturally occurring formaldehyde in foods, data may not be available for every food. There have been reports of abusive use of formaldehyde in mung bean vermicelli, soya bean sticks and hydrated food (e.g. tripe) previously. Of the over 250 food samples analysed for formaldehyde between 2004 and September 2006, all the results were satisfactory. There is no cause for undue concern over formaldehyde exposure from food so long as you maintain a balanced diet.

As formaldehyde is water soluble, it is recommended, as a good risk reduction measure, that dried food should be thoroughly soaked during preparation (soaking water discarded). Food should also be washed and cooked thoroughly before consumption as a precautionary measure.

## Advice to the Consumers

1. Wash all food thoroughly with running tap water, as formaldehyde is soluble in water and washing can aid the removal of formaldehyde.
2. Soak dry groceries like dried mushrooms thoroughly in clean water before cooking and discard the water.
3. Cook all food thoroughly to an internal temperature of 75°C or above, as heat from cooking can also aid the removal of formaldehyde. For fish, check the flesh to see whether it has turned opaque and can be separated easily.

## Advice to the Trade

1. Source food products from credible sources.
2. Do not add formaldehyde to food.

## Further Information

Readers may obtain further information on formaldehyde in food from the following websites:

- [The CFS Press Release](#)
- [The CFS Food Alert](#)
- [The CFS Risk in Brief on Formaldehyde in Food](#)

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

風險傳達工作一覽 (二零零六年十二月) Summary of Risk Communication Work (December 2006)	數目 Number
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# 食物中的防腐劑

## Preservatives in Food

食物安全中心風險評估組  
科學主任朱源強先生報告

Reported by Mr. Johnny CHU, Scientific Officer,  
Risk Assessment Section, Centre for Food Safety

食物是容易腐爛的物品，如果沒有妥善保存，可能會助長細菌、酵母菌和霉菌等不同微生物滋長，繼而令食物腐壞。此外，致病微生物及／或其有毒分泌物偶爾亦可能存在于食物中，人們吃下這些東西可能會對健康有害。

使用防腐技術保持食物新鮮美味已有長久的歷史。自遠古以來，人類需要保存食物在天氣欠佳時(例如冬季、雨天和乾旱的日子)仍可食用，多種防腐方法因此應運而生。這些方法包括烹煮、風乾、煙薰、醃製和使用防腐劑。

### 何謂防腐劑？

防腐劑屬於抗菌劑，旨在防止或減慢霉菌、酵母菌和細菌滋長。人們在中世紀已利用硝石保存肉類，時至今日，則使用硝石中的活性成分亞硝酸鹽加工處理煙肉和火腿。至於其他防腐劑例子，還有苯甲酸、二氧化硫、山梨酸和丙酸，當中有些天然存在于某些食物中，例如苯甲酸是布祿、越橘和丁香中的天然成分，而丙酸則自然存在于部分芝士中。

常見防腐劑、其主要作用及應用

防腐劑	針對生物	應用於食物的例子
亞硫酸鹽	酵母菌和細菌	脫水蔬果、香腸
亞硝酸鹽	細菌	煙肉
丙酸	霉菌	麵包
山梨酸	霉菌	芝士、酒
苯甲酸	酵母菌和霉菌	汽水、茄汁

防腐劑防止霉菌、酵母菌和細菌滋長，能夠提高食物的安全，並讓食物可在貨架上或雪櫃內存放更久，從而避免浪費剩餘的季節性食物。

### 防腐劑安全嗎？

所有防腐劑均須通過嚴格的安全評估和審批程序。只有在證明建議使用量不會危害消費者健康的情況下，當局才會准許在食物使用防腐劑。

雖然許多由食物引起的過敏反應都是由奶類、魚類和花生等天然食物配料所致，但有時亦會由二氧化硫等食物添加劑引起。二氧化硫在多種食物(尤其是汽水、香腸、乾果和菜乾)中用作防腐劑。

亞硝酸鹽主要用於香腸、火腿、煙肉和醃肉，以抑制肉毒桿菌滋長。意外攝取大量亞硝酸鹽可引致一種名為“正鐵血紅蛋白血症”的血液病症。攝入的亞硝酸鹽結合胃部中的蛋白質，可能會形成N-亞硝基化合物。研究顯示，這種化合物屬於可能令人類患癌的物质，並可能增加患胃癌的風險。此外，亞硝酸鹽亦自然存在于穀類和蔬菜等食物中。

如消費者保持均衡飲食，便可以降低因偏食少種類食物引致過量攝入個別化學物的機會及其引致的風險。

Food is a perishable commodity. If not kept properly, it may support growth of a variety of microorganisms such as bacteria, yeasts and moulds. The growth of these microorganisms causes spoilage of food. Occasionally, pathogenic microorganisms and/or their toxic secretions may also be present in food, consumption of which may lead to harmful effects on human health.

Preserving techniques to keep food fresh or palatable have a very long history. Since ancient times, it has been necessary to keep supplies of harvested food edible over unfavourable periods such as winter, rainy periods and drought. As such, a number of preserving methods had been invented to cope with the need. These include boiling, drying, smoking, salting and the use of preservatives.

### What are Preservatives?

Preservatives serve as antimicrobials which prevent or slow down the growth of moulds, yeasts and bacteria. In Middle Ages, saltpetre was used to preserve meat. Nowadays, nitrite, the active ingredient in saltpetre, is used for curing bacon and ham. Benzoic acid, sulphur dioxide, sorbic acid and propionic acid are other examples of preservatives. Some of these chemicals are natural. For example, benzoic acid is a natural constituent in plums, cranberries and cloves and propionic acid occurs naturally in some cheeses.

Some Common Preservatives, Their Primary Functions and Applications

Preservatives	Target Organism(s)	Examples of Application(s) in Food
Sulphite	Yeasts and bacteria	Dehydrated fruits and vegetables, sausages
Nitrite	Bacteria	Bacon
Propionic acid	Moulds	Bread
Sorbic acid	Moulds	Cheeses, wines
Benzoic acid	Yeasts and moulds	Soft drinks, ketchup

By preventing the growth of moulds, yeasts and bacteria, preservatives can improve the safety of food as well as prevent the wastage of seasonal surplus by making it last longer on the shelf or in the fridge.

### Are Preservatives Safe?

All preservatives must go through rigorous safety assessment and approval procedures. They are permitted for food use only when they are proved to present no hazard to the health at the level of use proposed.

Although many allergic reactions to foods are caused by natural food ingredients such as milk, fish and peanuts, some are caused by food additives such as sulphur dioxide. Sulphur dioxide is used as preservative in a wide range of foods, in particular soft drinks, sausages, dried fruits and vegetables.

Nitrite is mainly used in sausages, ham, bacon and pickled meat to inhibit the growth of *Clostridium botulinum*. Accidental intake of large amount of nitrite can cause a kind of blood disorder called methaemoglobinaemia. Ingested nitrite, in the presence of protein substances in the stomach, may form N-nitroso compounds, which have been shown to be probable human carcinogen and may increase the risk of stomach cancer. Nitrite also occurs naturally in food like cereals and vegetables.

If consumers have balanced diets, exposure to a specific chemical will be lowered and so is the risk.



有些消費者仍然關注亞硝酸鹽和二氧化硫等防腐劑的安全。為回應這些關注，以及使可能對某些防腐劑敏感的消費者能夠識別和迴避這些物質，由二零零七年七月起，本港市面上的預先包裝食物必須在標籤上標示當中的食物添加劑(包括防腐劑)名稱或識別編號。

### 本港如何規管防腐劑？

在《食物內防腐劑規例》(第132BD章)列明那些防腐劑獲准在食物使用及其在指明食物中的最高含量。目前，該規例一共載列了12種准許防腐劑和91種指明食物。

食物安全中心(中心)現正檢討該規例，並已就此事發表諮詢文件。有關文件及公眾諮詢會詳情見中心網頁。

Some consumers are still concerned about the safety of some preservatives such as nitrite and sulphur dioxide. To address their concern and enable those who may be allergic to specific preservatives to identify and avoid them, the presence of food additives (i.e. including preservatives) in prepackaged food available in Hong Kong must be identified by their names or identification numbers on the label of the food after July 2007.

### How are Preservatives Regulated in Hong Kong?

The Preservatives in Food Regulations, Cap. 132BD (the Regulations) stipulate which preservatives are permitted for food use and their maximum levels in specified foods. At present, there are a total of 12 permitted preservatives and 91 specified foods in the Regulations.

The Centre for Food Safety (CFS) is currently reviewing the Regulations and has issued a consultation paper on the subject. The consultation paper and details of public consultation forums are available at the [CFS website](#).



### 維他命K：知多一點

在二零零六年十二月十五日，食物安全中心發出食物警報，呼籲正服用薄血藥華法林納(warfarin)的病人應就飲用添加了維他命K的安怡 Phyto K 奶類產品，徵詢醫生意見。

維他命K是不可或缺的脂溶性微量營養素，對人體維持正常凝血功能有顯著作用。另一方面，其促進骨骼健康的功用則仍有待確定。

含豐富維他命K的食物包括綠葉蔬菜、菜油(例如大豆油和芥花籽油)，以及芝士等某些發酵食物。食物補充品(例如綜合維他命)和部分營養奶及健康飲品亦可能含維他命K。這種微量營養素除了可從上述膳食途徑中攝取外，亦可透過腸內細菌合成產生。

因飲食中攝入量不足以致維他命K缺乏的病例罕見。身體健康的成年人從食物或補充品攝入維他命K而對健康造成不良影響的例子亦從未聽聞。市民只須進食不同種類的食物，保持均衡飲食，就能達到每日建議的維他命K攝入量。

### Vitamin K: A Brief Encounter

On 15 December 2006, the Centre for Food Safety issued a [food alert](#) to warn people who are taking the blood thinning drug, warfarin, to seek medical advice on consumption of Anlene Phyto K milk products which contain added vitamin K.

Vitamin K is an essential fat-soluble micronutrient with an unequivocal function in maintaining normal blood clotting. On the other hand, its role in promoting bone health yet remains to be confirmed.

Good food sources of vitamin K include green leafy vegetables, vegetable oils (e.g. soybean oil and canola oil), as well as certain fermented foods such as cheese. Dietary supplements (e.g. multivitamins) and some fortified milk and health drinks may also contain vitamin K. In addition to these dietary sources, vitamin K is synthesized by bacteria in our intestines.

Clinical vitamin K deficiency due to inadequate dietary intake is rare and no adverse effects associated with vitamin K consumption from food or supplements among healthy adults have been reported. Members of the public should be able to meet the daily recommended intake for vitamin K simply by maintaining a varied and balanced diet.

### 食物中使用甜菊糖甙作甜味劑

食物安全中心(中心)近日發現在本港出售的部分零食產品含有甜菊糖甙這種非准許甜味劑。

甜菊糖甙屬於甜菊醇甙中的主要元素，是從植物中抽取出來的高甜度、低熱量甜味劑，其甜味約為蔗糖的250至300倍。甜菊醇甙在中國、日本和韓國等國家獲准在食物中用作甜味劑，但在澳洲、加拿大、歐洲聯盟成員國、新加坡、美國和本港則不然。

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(只有英文版))在二零零四年曾評估甜菊醇甙的安全，認為這物質不會導致基因中毒，亦不會令人患癌，按一般進食量進食不會引起安全問題。不過，專家委員會關注到甜菊醇甙對高血壓患者的血壓水平和糖尿病患者的血糖水平有潛在藥物作用，因此認為需取得更多科學數據作進一步評估。有鑑於此，中心認為現時不宜准許甜菊醇甙在食物中用作甜味劑。我們會密切留意此事，特別是專家委員會日後就甜菊醇甙進行的安全評估。

### Stevioside Used as Sweetener in Food

The Centre for Food Safety (CFS) recently found that some snack products on sale locally contained a non-permitted sweetener, stevioside.

Stevioside, a major component of steviol glycosides, is a sweetener extracted from plants. It is a high intensity low calorie sweetener approximately 250-300 times sweeter than sucrose. Steviol glycosides are permitted to be used as sweeteners in food in countries like China, Japan and Korea, but not in Australia, Canada, EU, Singapore, USA and also not in Hong Kong.

Safety evaluation of steviol glycosides was conducted by the Joint Food and Agriculture Organization / World Health Organization Expert Committee on Food Additives (JECFA) in 2004. It was concluded that steviol glycosides did not demonstrate any toxic effect on genes nor cancer-causing potential. There is no safety concern upon normal consumption. However, the JECFA raised concern about their potential pharmacological effects on blood pressure and blood glucose levels among individuals with hypertension and diabetes respectively, and therefore considered that more scientific data would be required for further evaluation. As such, the CFS does not consider it timely to permit the use of steviol glycosides as sweeteners in food. The subject will be kept in view, particularly the future safety assessment of steviol glycosides by the JECFA.

