食物安全焦點
Food Safety Focus

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食物環境衞生署 Food and Environmental Hygiene Department

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本期內容 IN THIS ISSUE

編輯委員會 EDITORIAL BOARD

焦點個案 Incident in Focus

塑化劑與食物安全
Plasticisers and Food Safety

食物安全中心
風險評估組
科學主任陳蓉蓉女士報告

Reported by Ms. Melva CHEN, Scientific Officer,
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本欄在上一期闡述了食物安全中心(中心)就台灣的塑化劑污染食物事件所採取的應變行動。由於陸續發現有關塑化劑的潛在問題，市民仍然關注事件，故本文會繼續討論有關塑化劑的風險及相關食物安全事宜。

塑化劑主要用於聚氯乙烯(PVC)產品

自發生塑化劑污染食物事件後，許多人擔心塑化劑從塑膠物料遷移至食物的情況和相關的健康問題。其實，塑化劑是用來加入硬塑料中，使更具彈性和更加耐用。PVC是最常使用塑化劑的硬塑料，因此，用PVC製成的食物容器、商用保鮮紙、用來密封玻璃瓶的金屬蓋墊片、輸送帶、手套以及黏合劑和食物包裝上的印墨都含有塑化劑。而軟塑料（例如聚對苯二甲酸乙二醇酯(PET)及聚乙烯(PE)）本身具有彈性，因此無須使用塑化劑(見表一)。

塑化劑之中，業界常用的有多種，包括鄰苯二甲酸酯類、己二酸類、環氧酯類和檸檬酸類等，當中以鄰苯二甲酸酯類(例如鄰苯二甲酸二(2－乙基己酯)(DEHP)及鄰苯二甲酸二正丁酯(DBP))在規管和科研方面最受關注，因為這類塑化劑對實驗動物的生殖及發育具有毒性影響。

In the past issue we talked about our responses to plasticiser-tainted food incident originated in Taiwan. Concerns remain as potential problems associated with plasticisers continue to unfold. This article continues to discuss risks associated with plasticisers and the related food safety issues.

Plasticisers are Used Primarily in Polyvinyl Chloride (PVC) Products

Since the emergence of the plasticiser-tainted food incident, many people worried about the migration of plasticisers from plastic materials into food and the associated health risk. In fact, plasticisers are substances mainly used in hard plastics to improve their flexibility and durability. PVC is the most common hard plastic material that uses plasticisers. Therefore, food containers, commercial cling films, gaskets used to seal the metal lids of glass jars, conveyer belts, gloves, made of PVC as well as adhesives and printing ink on food packaging contain plasticisers. On the other hand, soft plastics such as polyethylene terephthalate (PET) and polyethylene (PE) are inherently flexible and therefore do not require the use of plasticisers (see Table 1).

The industry has been using many types of plasticisers including phthalates, adipates, epoxy esters and citrates. Of these, phthalates such as DEHP and DBP have received the most regulatory and scientific attention due to their toxicity on reproduction and development in experimental animals.

表一：塑膠物料的種類及應用

Table 1. Types and Applications of Plastic Materials

標誌* Code*	塑膠種類 Type of plastic	在生產過程中使用塑化劑 Use of plasticisers in production	耐熱程度 Heat resistance	常見的食物接觸產品例子 Common food contact applications
1 PET 或or 1 PETE	聚對苯二甲酸乙二醇酯 Polyethylene Terephthalate (PET/PETE)	不需要 Not required	在攝氏80度會變軟 Softens at 80°C	用完即棄飲料瓶 Disposable beverage bottles
2 HDPE	高密度聚乙烯 High Density Polyethylene (HDPE)	不需要 Not required	在攝氏75度會變軟 Softens at 75°C	奶類飲料瓶、乳酪飲料瓶 Milk jugs, yogurt drinks bottles
3 PVC 或or 3 V	聚氯乙烯 Polyvinyl Chloride PVC/V)	需要 Required	在攝氏80度會變軟 Softens at 80°C	玻璃瓶的金屬蓋墊片、商用保鮮紙、手套 Gaskets in metal lids for glass jars, commercial cling film, gloves
4 LDPE	低密度聚乙烯 Low Density Polyethylene (LDPE)	不需要 Not required	在攝氏70度會變軟 Softens at 70°C	保鮮紙、食物袋 Cling film, food bags
5 PP	聚丙烯 Polypropylene (PP)	不需要 Not required	在攝氏140度會變軟 Softens at 140°C	可用於微波爐的容器、飲管 Microwaveable containers, straws
6 PS	聚苯乙烯 Polystyrene (PS)	不需要 Not required	在攝氏95度會變軟 Softens at 95°C	用完即棄的外賣盒 Disposable take-away containers
7 OTHER	所有其他塑膠（例如聚碳酸酯） All other resins (e.g. polycarbonate (PC))	視乎塑膠或合成塑膠而定（例如PC不需要使用塑化劑） Depends on plastic or combination of plastics used (e.g. not required for PC)	視乎塑膠或合成塑膠而定（例如PC在攝氏140度會變軟） Depends on plastic or combination of plastics used (e.g. PC softens at 140°C)	視乎塑膠或合成塑膠而定（例如PC可用來製造可再用飲料瓶） Depends on plastic or combination of plastics used (e.g. PC can be used to make reusable beverage bottles)

*註： 塑膠分類標誌系統是印在塑膠上用以識別聚合物種類的一組標誌，其主要目的是為了有效區分各類聚合物以供循環再用。

*Note: The resin identification code system is a set of symbols placed on plastics to identify the polymer type. The primary purpose of the codes is to allow efficient separation of different polymer types for recycling.

資料來源：環境保護署、新西蘭塑膠業協會、英國塑膠業聯會及國際生命科學學會

Source of information: Environment Protection Department, Plastics New Zealand, British Plastics Federation and International Life Sciences Institute

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焦點個案
Incident in Focus

影響塑化劑遷移至食物的因素

採用正確程序生產和使用的PVC食物接觸物料不會有過量的塑化劑遷移至食物中。但是，由於塑化劑會溶於油中，因此，含塑化劑（尤其是鄰苯二甲酸酯類）的塑膠物料(即PVC產品)不應用於盛載油性食物的食物接觸物料。本港及海外數據顯示，食油、油性醬料及芝士等部分油性食物曾驗出含有小量鄰苯二甲酸酯，可能由環境污染或不當使用食物接觸物料所致。溫度越高及接觸時間越長，塑化劑的遷移量就越多。此外，由於嬰幼兒較易受鄰苯二甲酸酯的毒性影響，含鄰苯二甲酸酯類塑化劑的塑膠物料不應用作專供盛載三歲以下嬰幼兒食物的食物接觸物料。總的來說，食物接觸物料生產商有責任為旗下產品進行使用前測試，以確保產品在指定條件下可供安全使用。

注意要點：

1. 塑化劑主要用於PVC產品。
2. 當PVC物料與油性或高溫食物接觸，塑化劑的遷移量會增加。
3. 由於塑化劑是廣泛存在於環境中的污染物，我們無可避免會攝入小量塑化劑，但正確使用食物接觸物料可減少攝入量。

What Affects Migration of Plasticisers into Food

When PVC food contact materials are properly manufactured and used, the plasticisers contained in the materials are not expected to migrate excessively into foodstuffs. However, as plasticisers are oil-soluble, plastics containing plasticisers, especially phthalates (i.e. in the case of PVC products) should not be used in food contact materials for holding fatty foods. Local and overseas data showed that some fatty foods such as edible oils, oil-based sauces and cheese were detected with low levels of phthalates, possibly related to environmental contamination or inappropriate use of food contact materials. Migration of plasticisers also increases with temperature and contact time. Plastics containing phthalates plasticisers should not be used in food contact materials intended for foods for infants and children under three years old as they are more susceptible to the toxicity of phthalates. On the whole, manufacturers of food contact materials have the responsibility to conduct prior use tests on their products to ensure that they are safe under the intended conditions of use.

Key Points to Note:

1. Plasticisers are used primarily in PVC products.
2. Migration of plasticisers from PVC materials increases when in contact with fatty or hot foods.
3. Exposure to low level of plasticisers is unavoidable due to their widespread presence as environmental contaminants but can be reduced with proper use of food contact materials.

中心採取的行動

中心一直主動跟進台灣食品攙雜塑化劑一事，尤其在以下兩方面：

(1) 監察及檢測：中心已加強監察食物，並檢測不同類別食品的鄰苯二甲酸酯含量，包括DEHP、鄰苯二甲酸二異壬酯(DINP)及DBP。此外，中心又與業界緊密合作，盡量減低對市民造成的影響。如有食物對市民健康構成潛在風險，中心會發出新聞公報和食物警報。

(2) 風險傳達：中心已特設“食物中含塑化劑”網頁提供檢測結果及最新情況，闡釋市民關注的問題。中心網頁亦載列有關食物接觸物料的安全資料，包括外賣飯盒雜質釋出量、即食杯麵容器及本地食肆使用的仿瓷餐具的風險評估研究，以及雙酚A和再用PET膠樽的《風險簡訊》。

Actions Taken by the CFS

The CFS has been actively managing the plasticiser-tainted food incident originated in Taiwan, especially in two main aspects:

(1) Surveillance and Testing: The CFS has enhanced surveillance and testing of various categories of food products for phthalates including DEHP, DINP and DBP. We have worked closely with trade on minimising the impact to the public. Press release and food alerts will be issued when public health is of concern.

(2) Risk Communication: The public are updated on the test results and the latest development at the CFS designated webpage Plasticisers in Food which also provides explanations to questions that are of public concern. The CFS webpage provides safety information related to food contact materials, including risk assessment studies of disposable plastic containers for take-away meals, instant cup noodle containers and melamine-ware available for use on local food premises and risk-in-briefs on the safety of bisphenol A and reusing of PET bottles.

減少從食物攝入塑化劑

塑化劑是廣為使用的工業化學物。由於塑化劑廣泛存在於環境中的污染物，我們無可避免會透過食物、水或皮膚與塑膠接觸等不同途徑攝入小量塑化劑。人體可有效代謝和排出鄰苯二甲酸酯等塑化劑。攝入小量鄰苯二甲酸酯不會影響健康，我們更可採取以下措施減少攝入鄰苯二甲酸酯。

Reducing Exposure to Plasticisers from Food

Plasticisers are widely used industrial chemicals. Due to their widespread presence as environmental contaminants, exposure to low levels of plasticisers through food, water or skin contact with plastics is unavoidable. Our bodies can effectively metabolise and excrete plasticisers such as phthalates. Exposure to low levels of phthalates is unlikely to pose a health risk. We can take the following measures to reduce our exposures to phthalates.

給消費者的建議

1. 使用塑膠食物容器時，應遵從生產商的指示，特別是溫度限制和在微波爐和洗碗碟機使用的指示。
2. 切勿使用PVC或用料不明的塑膠容器盛載油性或高溫食物，應改用玻璃、陶瓷或不銹鋼容器。
3. 使用或重複使用玻璃瓶時，應確保油性食物不會與蓋口墊片接觸。

Advice to Consumers

1. Follow manufacturer's instructions especially on the temperature specifications and microwave and dishwasher instructions when using plastic food containers.
2. Do not use PVC or unidentified plastic containers to hold fatty foods or hot foods. Use glass, ceramic or stainless steel containers instead.
3. When using or reusing glass jar, make sure the fatty foods do not come into contact with the gasket of the lid.

給業界的建議

1. 食物接觸材料生產商應提供產品資料和使用指示。
2. 食物業應奉行優良製造規範和有關食物安全的良好習慣，並確保食品符合本港規例。
3. 避免使用含鄰苯二甲酸酯的食物接觸物料盛載食物，特別是油性食物和專供嬰幼兒食用的食物。

Advice to the Trade

1. Manufacturers of food contact materials should provide product information and instructions on use.
2. Food trade should observe good manufacturing and food safety practice. Ensure food products comply with local regulations.
3. Avoid using phthalate-containing food contact materials, especially for fatty foods and food intended for infants and young children.

食物安全平台
Food Safety Platform

植物生長調節劑是什麼？
What are Plant Growth Regulators?

食物安全中心
風險評估組
科學主任邱頌韻女士報告

Reported by Ms. Joan YAU, Scientific Officer,
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近期，我們注意到城中熱話是“帶花青瓜”和“爆炸西瓜”，並引起市民關注植物激素及植物生長調節劑的使用。究竟植物激素及植物生長調節劑是什麼？它們會否損害人體健康呢？

從植物激素到植物生長調節劑

植物激素是植物體內自行產生的物質，對調節植物的生長至為重要。植物激素控制或改變植物的生長過程，例如葉片和花朵的形成、莖部伸長及果實的發育與成熟。

在現代農業中，人們把植物激素進而應用於調節其他植物的生長。如天然或合成的物質用於這一用途，這些物質就可稱為植物生長調節劑。

在農業中應用植物生長調節劑的做法始於三十年代的美國。乙烯屬於天然存在的物質，是人們最先發現可有效促進菠蘿開花的其中一種植物生長調節劑。乙烯對人體的毒性影響為低。此外，人們又生產出類似這些天然植物激素的合成物質。自此以後，植物生長調節劑逐漸流行，成為現代農業中的重要部分。

三種常見的植物生長調節劑

多年以來，乙烯一直是最廣為人知的植物生長調節劑之一。它是一種氣體植物激素，對香蕉、蘋果、梨子和瓜類等多種水果的成熟過程有重要的調節作用，可由開始成熟的水果天然產生或來自乙烯利等人工來源。大家不妨試做這個小實驗：把未熟的香蕉和開始成熟的水果(如蘋果)放進同一紙袋裏，然後蓋上袋口。開始成熟的蘋果會產生乙烯，有助加快香蕉的成熟過程，翌日你就可吃到熟了的香蕉。

生長素及其有關化合物是另一大類的植物生長調節劑。生長素的最早研究旨在誘發和加速枝條發根。吲哚乙酸是一種天然生長素，在三十年代為人發現。其後，專家陸續研製出各種人工合成的生長素，例如吲哚丁酸及萘乙酸。人工合成的生長素應用範圍甚廣，包括預防蘋果出現落果現象。

至於近期報道引致“爆炸西瓜”的“疑凶”，則是名為“氯吡脲”的植物生長調節劑。這種化學物是合成的植物生長調節劑，屬於苯基脲型細胞分裂素(可促進細胞分裂和分化)。氯吡脲會令葡萄、奇異果及西瓜等水果的果實增大和提高產量。正確施用氯吡脲(即奉行優良務農規範)可把食物中的氯吡脲殘留量減至最低，食用安全風險不高。

We noticed the recent hot topics are “cucumber with flowers” and “exploding watermelon” which raised public concerns about the use of plant hormones and plant growth regulators. What are plant hormones and plant growth regulators? Are they hazardous to human health?

From Plant Hormone to Plant Growth Regulator

Plant hormones are produced naturally by plants and are essential for regulating their own growth. They act by controlling or modifying plant growth processes, such as formation of leaves and flowers, elongation of stems, development and ripening of fruit.

In modern agriculture, people have established the benefits of extending the use of plant hormones to regulate growth of other plants. When natural or synthetic substances used in this manner, they are called Plant Growth Regulators.

The application of plant growth regulators in agriculture has started in the 1930s in the USA. Ethylene, a naturally occurring substance, is one of the first plant growth regulators being discovered and used successfully for enhancing flower production in pineapple. Its toxic effects to human beings are low. Synthetic substances that mimic such naturally occuring plant hormones were also produced, since then the use of plant growth regulators has been growing significantly and becoming a major component in modern agriculture.

Three Common Plant Growth Regulators

Over the years, ethylene has continued to be among the best known examples of plant growth regulators. It is a gaseous plant hormone playing a key regulatory role in ripening of many types of fruits, including banana, apple, pear and melons. It can be produced naturally by ripening fruit or from synthetic sources such as ethephon. Try this experiment: put raw bananas and a ripening fruit (e.g. apple) in the same paper bag and cover it up. Ethylene produced by the ripening apple will speed up the ripening process of bananas, giving you the ripe bananas next morning.

Another major class of plant growth regulators are auxins and related compounds. The earliest study on auxins was intended for the initiation and acceleration of the rooting of cuttings. The natural auxin, indole-3-acetic acid, was identified in 1930s. Later on, synthetic auxins such as indolebutyric acid and naphthylacetic acid were developed. Synthetic auxins have a wide range of applications including the prevention of fruit drop in apples.

The recently reported “suspect” causing “exploding watermelon” is also a plant growth regulator, a chemcial called forchlorfenuron. It is a synthetic plant growth regulator under the group called phenylurea type cytokinin, which can induce cell division and cell differentiation. Forchlorfenuron is known to increase size and yield of fruits such as grapes, kiwifruits and watermelon. Proper use of forchlorfenuron (i.e. following the good agricultural practice (GAP)) will result in minimal residue in food and hence low food safety risk.

令香蕉變熟的小實驗：把未熟的香蕉和開始成熟的蘋果一同放進同一紙袋裏，然後蓋好袋口。經過一夜後，你會發現香蕉變熟了(與沒有放進紙袋裏的香蕉比較)。這是因為開始成熟的蘋果或其他水果會產生乙烯，令香蕉變熟。

Ripening experiment: put a raw banana into a paper bag together with a ripening apple, cover it up, place over night. Next morning you will find the banana ripened as compared with one that is left in air. The effect is due to the banana's exposure to ethylene released by the ripening apple or other ripening fruits that may be present.

植物生長調節劑與食物安全

在規管方面，植物生長調節劑屬於“除害劑”的類別。在國際上，食品法典委員會及發達國家有關主管當局等系統和本港的《除害劑條例》(第133章)均採用相同的分類。

國際上公認的除害劑規管原則，要求所有除害劑包括植物生長調節劑，均須向有關主管當局註冊，然後才可用於農務中。在

Plant Growth Regulators and Food Safety

From the regulatory control perspective, plant growth regulators are classified under “pesticides”. The same classification applies both internationally, under the Codex systems and competent authorities of developed countries, as well as locally in the Pesticides Ordinance, Cap 133.

As a well accepted principle, all pesticides, including plant growth regulators, have to be registered with the competent authority before application

註冊過程中除害劑的安全性和成效將會經過全面的評估。農民如按照優良務農規範正確使用這些註冊除害劑(包括植物生長調節劑)，可把食物中的植物生長調節劑殘餘量減至最低，而有關食物的食用安全風險極低。優良務農規範是一套安全施用除害劑(例如與公眾健康和環境安全相關的考慮)的國家認可規定，以便有效和穩妥地防治害蟲。准許施用除害劑的食品類別、建議施用次數、頻率和分量，以及農作物在最後一次施用除害劑後須經過多久才可收割等各項規定，均會詳載於優良務農規範中。

結語

總結而言，植物生長調節劑是一組可控制和促進植物的自然生長過程的化學物，有助滿足整體食物供應的需求。食品法典委員會設有機制，監察食物中的殘餘除害劑（包括生長調節劑），以制定標準和保障公眾健康。

in agriculture. Their safety and efficacy will be thoroughly assessed during the registration process. Proper use of these registered pesticides including plant growth regulators in accordance with GAP will result in minimal residue in food of insignificant food safety risk. GAP is a set of nationally authorised conditions to use the pesticide safely (e.g. in relation to public health and environmental safety concerns) for effective and reliable pest control. Various conditions, such as the type of commodities authorised for using the pesticide, the recommended application rates, frequencies, and amount as well as the duration between the last application of the pesticide and harvest, are prescribed in the GAP.

Conclusion

In conclusion, plant growth regulators are a group of chemicals for controlling and enhancing the natural plant growth processes to better meet the requirements of food supply in general. Mechanisms are in place under the Codex system to oversee residues of pesticides (including plant growth regulators) in food for setting standards and public health protection.

食物事故點滴
Food Incident Highlight

德國及法國爆發腸道出血性大腸桿菌疫症

今年五月及六月，德國和法國爆發腸道出血性大腸桿菌疫症，導致嚴重疾病和數宗死亡個案。德國的調查顯示，發芽的種子／豆類可能是傳播疫症的媒介。

腸道出血性大腸桿菌是大腸桿菌其中一部分的致病性菌株，可令患者出現出血性腹瀉，部分人更會有溶血尿毒症。此症是一種嚴重併發症，損害腎臟後可致命。腸道出血性大腸桿菌可透過進食受污染的水和食物傳播。此外，這種致病菌亦可經口糞途徑傳播給他人。曾涉及人類個案爆發的腸道出血性大腸桿菌類型包括最常見的O157:H7型大腸桿菌和是次疫症所牽涉較少見的O104:H4型大腸桿菌。

腸道出血性大腸桿菌主要存在於動物(特別是反芻動物)的腸道內，亦見於受污染的牛肉及奶製品，例如免治牛肉、未經高溫消毒的奶和芝士。進食受污染的水和食物(包括受污染的水果及蔬菜)亦會引致感染。由於烹煮過程可殺死大腸桿菌，故徹底煮熟食物能降低食用安全的風險。

新鮮水果及蔬菜應以流動的清水徹底洗淨。至於堅實的蔬果，例如瓜類水果和青瓜，應以清潔的蔬果刷刷洗表面。由於各種芽菜都是在溫暖潮濕的環境中發芽生長，而這種環境亦有利於微生物的生長，故芽菜應徹底煮熟才進食。市民應把碎牛肉和漢堡肉徹底煮熟至肉類中心部分呈啡色，而肉汁應清澈和不帶粉紅色。

大家應時刻奉行食物衞生守則：處理食物前和如廁後以肥皂和水洗手，分開存放生和熟的食物。如患有或懷疑感染傳染病或腸胃不適，食物從業員應停止處理食物。

Outbreaks of Enterohaemorrhagic *E. coli* Infection in Germany and France

In May and June 2011, outbreaks of enterohaemorrhagic *E. coli* (EHEC) infection occurred in Germany and France causing severe illness and some deaths. Investigations in Germany showed that sprouted seeds/beans were the likely vehicles for the infection.

EHEC is a pathogenic subset of *E. coli* bacteria which can cause bloody diarrhoea in infected individuals and in some cases haemolytic uraemic syndrome, a serious complication which can be fatal after causing kidney damage. EHEC can be spread through consumption of contaminated water and food. Moreover, person-to-person transmission of this pathogen is possible through faecal-oral route. EHEC types that have been associated with human outbreaks include the predominant O157:H7 and the rarer O104:H4 incriminated in this outbreak.

EHEC is mainly present in intestines of animals, especially ruminants, and can be found in contaminated beef and dairy products such as minced beef, unpasteurised milk and cheese. Consumption of contaminated water and foods including contaminated fruits and vegetables can also cause infections. As *E. coli* bacteria can be killed by cooking, thorough cooking can reduce food safety risk.

Fresh fruits and vegetables should be washed thoroughly in clean running water. For firm produce, such as melons and cucumbers, the surface should be scrubbed with a clean produce brush. It is recommended to cook sprouts thoroughly before consumption since sprouts of any kind are grown in warm and humid conditions which are also favourable for the growth of microorganisms. The public is advised to cook all ground beef and hamburgers thoroughly until the cooked meat is brown throughout and the juices run clear.

People should always follow food hygiene measures: washing their hands with soap and water before handling food and after using the toilet, keeping raw and cooked foods separate. Food handlers should suspend from handling food when suffering or suspected to be suffering from an infectious disease or gastro-intestinal disturbances.

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

風險傳達工作一覽（二零一一年六月） Summary of Risk Communication Work (June 2011)	數目 Number
事故/食物安全個案 Incidents / Food Safety Cases	77
公眾查詢 Public Enquiries	469
業界查詢 Trade Enquiries	396
食物投訴 Food Complaints	447
給業界的快速警報 Rapid Alerts to Trade	51
給消費者的食物警報 Food Alerts to Consumers	12
教育研討會/演講/講座/輔導 Educational Seminars / Lectures / Talks / Counselling	78
上載到食物安全中心網頁的新訊息 New Messages Put on the CFS Website	71