# Information about PFAS in Vietnam from 2014 – 2018

## Summary

This report summarizes press reports and scientific studies on per- and polyfluoroalkyl substances (PFAS) in Vietnam from 2014 - 2018.

Scientific studies of PFAS and examination of regulatory policy in Vietnam raise concerns about these substances and reinforces the need for regulatory action.

The principal findings of this report are:

**PFAS substances are largely unregulated in Vietnam**
Vietnam became a Party to the Stockholm Convention in 2004 and the treaty added PFOS to its global restriction list in 2009. This amendment went into legal force in Vietnam in 2010. However, other PFAS substances are essentially unregulated. Four policy measures have been enacted dealing with PFOS: 1) Guidance on Inventory Techniques, Safety Management and Risk Control for Perfluorooctane sulfonic acid, salts and perfluorooctane sulfonyl fluoride issued by the General Department of Environment - MONRE (18/06/2014); 2) Vietnam National Standards on some substances that are banned or restricted in footwear materials and products (2016); 3) and Decision no. 1598/QD-TTg on the National plan for the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) by 2025 with a vision to 2030 (17 October 2017). Some provincial governments also went further by detailing policies of the central government , such as An Giang province with the Plan No. 178 / KH-UBND about implementation of Decision no. 1598/QD-TTg in the province on April 6, 2018.

**Women are contaminated with PFAS substances**
A 2008 study found significant PFAS levels for PFOS, PFOA, PFNA, PFBS and PFHpA in women from Hanoi and Ho Chi Minh City. Overall, average PFOS levels in Vietnamese breast milk were 3.75 times higher than the drinking water health advisory limit of 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined in the US State of Vermont. The highest level of PFOS was approximately 20 times higher than this drinking water health advisory limit. In 2009, researchers studying PFAS in blood of women that had recently given birth found PFOS, PFOA and PFHxS in >98% of the women and levels were similar to those observed in the US. Levels were higher in an urban coastal area (Nha Trang) than a rural inland area (Dien Khanh). An earlier study found PFOS and PFOA in the blood of women from Hanoi with levels comparable to those observed in Osaka, Seoul, and Busan.

**PFAS water pollution is widespread**
A 2015 study found PFAS contamination in surface water, river water, and ground water. The most frequently detected PFAS substances in surface water were PFOA (98%), PFNA (84%, and PFOS (59%).

PFBA, PFHpA, PFOA, PFNA, PFDA, PFHxS and PFOS were the major PFAS found in ground water with PFOS and PFOA being the most prevalent. The highest levels were observed in samples from highly populated and industrialized areas, perhaps sourced from sewage. The authors noted that the high detection frequencies of PFOS and PFOA, "demonstrated that these chemicals are ubiquitous in the Vietnamese urban aquatic environment…" Sampling for a 2016 thesis found PFAS in Da Nang tap water up to 52 ppt and in surface water up to 132 ppt. Both exceed the drinking water health advisory limits in US states. The study also found high PFAS levels (292 ppt) in the discharging channel of an industrial zone. A 2017 study found the greatest concentrations of PFOA (53.5 ppt) and PFOS (40.2 ppt) were found in a surface water sample collected from a channel that receives wastewater treatment plant discharges. PFOS and PFHxS were found as the predominant PFAS substances in sediments. The variety of PFAS found in water included PFHxA, PFHpA, PFOA, PFNA, PFDA and PFUnDA indicating use of these substances or sources from precurors such as fluorotelomer alcohols in commerical products.

**Seafood is contaminated with PFAS substances**

A 2011 study measured the PFAS content of fish in samples of carp, snakehead, and catfish from India, Japan, Vietnam, Malaysia, and Thailand. Fish samples from Vietnam were collected in Bac Ninh, Hung Yen, and Long Xuyen. PFOS and PFNA levels were as high as 10 ng/g wet weight. The authors noted that PFOS and PFUA concentrations in livers of snakehead in Vietnam were greater than those in India and Malaysia, "suggesting that the degree of contamination with PFSs [PFAS] in Vietnam was greater than that in other tropical Asian developing countries." A subsequent study in 2016 found PFAS in a variety of seafood species. Dominant pollutants were PFUnDA in fish, PFTrDA in crustaceans, PFHxS in gastropods, and PFNA in bivalves.

**PFAS has been covered in many press articles, but the focus is on consumer products**

| Year | Number of articles; comment |
|---|---|
| 2014 | Seven; primarily about non-stick cookware and microwave popcorn containers; includes Greenpeace reports on PFAS in Disney, Burberry and Adidas children's clothes made in China and Adidas, Nike and Puma sportswear used in the 2014 World Cup. |
| 2015 | 16; raised concerns about possible negative effects on human health from PFAS in consumer products; noted research finding PFAS in dust and consumer products. |
| 2016 | 15; focused on possible health effects in consumer products such as non-stick cookware, pre-processed meat, microwave popcorn, popcorn bags, and fast food wrappers. |
| 2017 | 17; focused on benefits, harms and considerations when using non-stick cookware, the dangers of using popcorn bags, fast food wrappers with evidence from studies, scientists, nutritionists; news about remediation at Australian military bases and airports. |
| 2018 | 19; concerns about consumer products and information on selection and use of non-stick cookware and avoidance of PFAS-containing foods such as microwave popcorn. Also, news about PFAS and weight gain and a study of PFAS pollution in water and sediment in Vietnam which was conducted by a researcher of Institute of Environmental Science and Industry, University of Civil Engineering. |

**Some Vietnamese researchers are investigating PFAS**

Researchers include:

- Dr. Duong Thi Hanh (VAST); led the first nationwide study of PFAS in waters in Vietnam.
- Dr Dinh Quang Hung (HUST); developed a faster method for PFAS measurement in polluted water.
- Phung Thi Vi (HUS-VNU), master's thesis on surveying and evaluating the risk of PFAS pollution in water and sediment in textile and dyeing villages.
- Nguyen Hoang Lam (CNU); survey of PFAS in water, sediment and biota in Vietnam.

**PFAS elimination contributes to achievement of the Sustainable Development Goals**
Actions to control and phase-out PFAS as a class contribute to achievement of several key Sustainable Development Goals (SDGs) due to the impacts of the substances on health and ecosystems including water pollution. These include SDGs 3, 6, 9, 12, 14, 15, and 16.

# Introduction

## What are per- and polyfluoroalkyl substances (PFAS)?

PFAS is a large class of more than 4,500 persistent fluorinated chemicals. PFAS are both hydrophobic and lipophobic in nature and extremely persistent due to the strength of the carbon-fluorine bond. They are widely distributed in the global environment due to their high solubility in water, low/moderate sorption to soils and sediments and resistance to biological and chemical degradation. The properties of PFAS have resulted in extensive use as surfactants and surface-active agents in products. Two widely-used members of this class have been perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). As these two substances have come under regulatory pressure, the industry has shifted to other PFAS with similar properties.

Human exposure to PFAS is mainly by ingestion of contaminated food or water. These substances bind to proteins (not to fats) and persist in the body where they are mainly detected in blood, liver and kidneys. Studies indicate that PFOA and PFOS can cause reproductive and developmental, liver and kidney, and immunological effects in laboratory animals. Both chemicals cause tumors in animal studies along with a variety of other effects on infant birth weight, growth, learning, infant behavior, pregnancy, endocrine system, increased cholesterol, and thyroid function. Recent studies have linked a variety of PFAS substances to many human health effects: cardiovascular disease, markers of asthma, damage to semen quality, ovarian insufficiency, altered glucose metabolism, lower testosterone levels in male adolescents, association with shorter birth length in girls, elevated blood pressure, abnormal menstruation, lower birth weight in infants, possible increased risk of female infertility due to endometriosis, and decreased lung function in children with asthma.

The manufacture and use of PFAS and their use in a multitude of products has caused widespread pollution. PFAS are found in wildlife, accumulating in the blood, liver and kidneys of wildlife such as dolphins, polar bears, seals, birds, fish, and other marine wildlife. PFAS substitutes for PFOS and PFOA have been identified as potential global surface water contaminants and they have been found in more than 80% of 30 surface seawater samples from the North Pacific to Arctic Ocean. PFAS use in firefighting foams at military bases and airports is responsible for water pollution and contaminated communities in many countries, including Australia, Canada, China, Germany, Italy, Japan, Netherlands, New Zealand, South Korea, and Sweden.

Safer cost competitive non-fluorinated alternatives for PFAS use in firefighting foams have been adopted by an increasing number of major airports, including Auckland, Copenhagen, Dubai, Dortmund, Stuttgart, London Heathrow, Manchester, and all 27 major airports in Australia. Increasing awareness about the negative characteristics of PFAS has driven efforts to identify and market safer substitutes for other uses. Increasing awareness about the negative characteristics of PFAS has driven efforts to identify and market safer substitutes for other uses. Due to the complexity and negative characteristics of PFAS, there is increasing interest in regulating PFAS as a class rather than as individual substances.

## Early scientific studies raise concerns about PFAS in Vietnam

### Breast milk contains PFAS

In 2008, researchers in China, Japan, and the US published a study examining PFAS in breast milk from Cambodia, India, Indonesia, Japan, Malaysia, Philippines, and Vietnam. In addition, infant formula from five US manufacturers and 11 brands of dairy milk were tested. Samples from Hanoi and Ho Chi Minh City were collected in 2000 and 2001 for the study. The results were sobering.

**PFAS levels in Vietnamese breast milk from Hanoi and Ho Chi Minh City**

n = 40 Overall mean PFOS level = 75 ppt

| Substance | Range (ppt) | Fraction of samples containing (%) |
|---|---|---|
| PFOS | 17 – 393 | 100 |
| PFOA | <43 – 89 | 3 |
| PFHxS | <2 – 27 | 73 |
| PFNA | <9 – 11 | 5 |
| PFBS | <1 – 4 | 10 |
| PFHpA | <4 - 7 | 18 |

Every woman sampled from Vietnam had PFOS in her breast milk and 75% of them contained PFHxS – a toxic substance the industry proposed as a substitute for PFOS. The results showed significant PFAS levels for PFOS, PFOA, PFHxS, PFBS, and PFHpA. Overall, average PFOS levels in Vietnamese breast milk were 3.75 times higher than the drinking water health advisory limit of 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined in the US State of Vermont. The highest level of PFOS was approximately 20 times higher than this drinking water health advisory limit. Finally, the study found that PFAS levels in US infant formula and dairy milk were approximately 10-fold lower than levels in Asian breast milk. This resulted in a daily intake of PFOS by Asian infants that was 7 – 12 times higher than the dietary intakes previously reported for adults in Canada, Germany and Spain.

**PFAS is found in blood**

PFAS has also been found in the blood of Vietnamese women. In 2007 – 2008, a study compared PFAS in blood from women in Japan, South Korea, and Vietnam. The women from Vietnam were located in Hanoi. PFOS levels ranged from 1,890 – 14,600 ppt and PFOA levels ranged up to 1,570 ppt with mean levels at 730 ppt. These levels were comparable to those observed in Osaka, Seoul, and Busan. In 2009, researchers published the first study of PFAS in blood from women hours after giving birth. The women were from Khanh Hoa province in south central Vietnam – either in Nha Trang or the district of Dien Khanh. A variety of PFAS were found including PFHxS, PFHpS, PFOS, PFOA and PFNA. PFOS, PFOA and PFHxS were detected in >98% of the women and levels were similar to those observed in the US. Women from Nha Trang had significantly higher concentrations of PFAS than women from Dien Khanh. Nha Trang is an urban coastal area and Dien Khanh is a rural inland area – though seafood is consumed in both locations.

**Fish are contaminated with PFAS**

A 2011 study measured the PFAS content of fish in samples of carp, snakehead, and catfish from India, Japan, Vietnam, Malaysia, and Thailand. Fish samples from Vietnam were collected in Bac Ninh, Hung Yen, and Long Xuyen. PFOS and PFNA levels were as high as 10 ng/g wet weight. The authors noted that PFOS and PFUA concentrations in livers of snakehead in Vietnam were greater than those in India and Malaysia, "suggesting that the degree of contamination with PFSs [PFAS] in Vietnam was greater than that in other tropical Asian developing countries."

## Actions on PFAS and the Sustainable Development Goals

Actions to control and phase-out PFAS as a class contribute to achievement of several key Sustainable Development Goals (SDGs) due to the impacts of the substances on health and ecosystems including water pollution. These include:

**Sustainable Development Goal 3: Ensure healthy lives and promote well-being for all at all ages.** Targets under SDG3 include:
3.4: *"reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being"*
3.9: *"substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination."*

**Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all.** Targets under SDG6 include:
6.3: *"improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally."*

**Sustainable Development Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.** Targets under SDG9 include:
9.4: *"greater adoption of clean and environmentally sound technologies and industrial processes."*

**Sustainable Development Goal 12: Ensure sustainable consumption and production patterns.** Targets under SDG12 include:
12.4: *"By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frame works, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment."*
12.5: *"substantially reduce waste generation through prevention, reduction, recycling and reuse."*
12.6: *"Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle."*
12.7: *"Promote public procurement practices that are sustainable, in accordance with national policies and priorities."*

**Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.** Targets under SDG14 include:
14.1: *"By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution."*

**Sustainable Development Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss**. Targets under SDG15 include:
15.1: *"By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements."*
15.5: *"Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species."*
15.9: *"By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts."*

**Sustainable Development Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.** Targets under SDG16 include:
16.7: *"Ensure responsive, inclusive, participatory and representative decision-making at all levels."*
16.10: *"Ensure public access to information…"*

### How this paper is organized

This paper describes information available in Vietnam (in both Vietnamese and English) about PFAS substances. This includes newspaper articles, policy documents, and scientific studies published between 2014 and 2018. The information is organized by year and demonstrates considerable attention to the PFAS topic in Vietnam. The keywords "FPAS + Việt Nam, PFOS + Việt Nam, PFOA + Việt Nam, PFAS + Vietnam, PFOS + Vietnam, PFOA + Vietnam" led PanNature's team to 100 Vietnamese articles on PFAS published from 2014 to 2018, of which 75 are original and the rest are republications.

# 2014

## Newspapers

### VIETNAMESE

1. **AN NINH THỦ ĐÔ: Các đồ dùng nhà bếp gây nguy hiểm cho sức khỏe (08/02/2014)**

https://anninhthudo.vn/doi-song/cac-do-dung-nha-bep-gay-nguy-hiem-cho-suc-khoe/563455.antd

The article says non-stick cookware could be dangerous for our health. The non-stick pan is coated with Teflon (PTFE) which is harmful to humans. When the pan is heated to high temperatures over a long period of time, PTFE emits toxic fumes, which can cause flu-like symptoms in humans and kill birds. Moreover, non-stick pans can also leak toxic chemicals directly into food, such as perfluorooctanoic acid (PFOA), which causes cancer, increases the risk for abnormal blood cholesterol, thyroid disease and infertility.

2. **GIÁO DỤC VIỆT NAM: 10 loại thực phẩm thường ngày dễ gây ung thư và có hại cho sức khỏe (12/02/2014)**

http://giaoduc.net.vn/Suc-khoe/10-loai-thuc-pham-thuong-ngay-de-gay-ung-thu-va-co-hai-cho-suc-khoe-post152889.gd

http://soha.vn/song-khoe/10-thuc-pham-gay-ung-thu-nhieu-nhat-ban-nen-tu-bo-han-khoi-bua-an-2014051916234463.htm (**20/05/2014)**

(Republish)http://genk.vn/kham-pha/nhung-loai-do-an-thong-thuong-va-tac-hai-khong-ngo-phan-ii-20140417233819797.chn

The article listed the top 10 cancer causing daily foods which includes microwave popcorn. The U.S. Environmental Protection Agency (EPA) recognizes the perfluorooctanoic acid (PFOA) in microwave popcorn bag linings as "likely" carcinogenic, and several independent studies have linked the chemical to cause tumors. Similarly, the diacetyl chemical used in the popcorn itself is linked to causing both lung damage and cancer.

3. **BÁO DÂN TRÍ: Tìm thấy nhiều chất nguy hiểm trong quần áo trẻ em từ Trung Quốc (15/01/2014)**

https://dantri.com.vn/the-gioi/tim-thay-nhieu-chat-nguy-hiem-trong-quan-ao-tre-em-tu-trung-quoc-1390248586.htm **(15/02/2014)**

(Republish) http://www.baoxaydung.com.vn/news/vn/kinh-te/tim-thay-nhieu-chat-nguy-hiem-trong-quan-ao-tre-em-tu-trung-quoc.html

Greenpeace study finds many hazardous chemicals in children's clothes and shoes made by major brands including Burberry, Adidas and Disney. These products were purchased in May and June 2013 in 25 countries or regions worldwide, from flagship stores or authorized retailers. They were manufactured in at least 12 different countries/regions, though a third of them were made in China. Every single brand tested was found to have some items containing hazardous chemicals such as PFOAs and NPEs. According to Greenpeace, nonylphenol ethoxylates (NPEs) is a group of chemicals that break down in the environment to form the hazardous chemical nonylphenols, which are known to be toxic, acting as persistent and bioaccumulative hormone disruptors. PFOA is an ionic polyfluourinated chemical that causes adverse impacts on the reproductive and immune systems, both during development and in adulthood.

4. **DÂN TRÍ: Phát hiện chất độc hại trong trang bị dùng cho World Cup (21/05/2014)**

https://dantri.com.vn/suc-khoe/phat-hien-chat-doc-hai-trong-trang-bi-dung-cho-world-cup-1401183989.htm

https://doanhnghiepvn.vn/do-the-thao-thuong-hieu-adidas-nike-chua-doc-chat-d20934.html **(23/05/2014)**

The report of Greenpeace found to contain ionic PFCs such as perfluorooctanoic acid (PFOA) in Adidas, Nike and Puma products purchased across three continents - including boots, goalkeeper gloves and Adidas Brazuca football (FIFA World Cup in Brazil).

5. **BÁO KIẾN THỨC: Tiết lộ mối nguy ung thư từ màng bọc thức ăn (14/05/2014)**

https://kienthuc.net.vn/tam-soat-ung-thu/tiet-lo-moi-nguy-ung-thu-tu-mang-boc-thuc-an-341371.html

The article says that the scientists found perfluorooctanoic acid (PFOA), a cancer-causing chemicals, in raincoat, plastic sheet for covering food.

6. **VNREVIEW: Sự thật về chảo chống dính (18/09/2014)**

https://vnreview.vn/tin-tuc-khoa-hoc-cong-nghe/-/view_content/content/1340760/su-that-ve-chao-chong-dinh

This is a comprehensve article about non-stick pans, from Teflon coating to related studies, as well as how to use non-stick pans properly and safely.

7. **VTC NEWS: Nguyên nhân gây vô sinh không ngờ (29/12/2014)**

https://vtc.vn/nguyen-nhan-gay-vo-sinh-khong-ngo-d187678.html

(Republish)http://danviet.vn/song-khoe/nguyen-nhan-gay-vo-sinh-khong-ngo-524375.html **(29/12/2014)**

The article says that causes of infertility may stem from daily products or daily routine such as non-stick pan, deodorant soap, hair loss medication...

**ENGLISH**

8. **EQUAL TIMES: Official FIFA football retails at twice the cost of workers wages (07/07/2014)**

https://www.equaltimes.org/official-fifa-football-retails-at?lang=fr#.XG7BjHIzY2x

Forward Sports, a company based in Sialkot in the province of Punjab, in eastern Pakistan, was awarded the contract to make the official football by Adidas, the world's second largest sporting goods manufacturer. Meanwhile, as part of its Detox campaign, Greenpeace has been investigating over 33 sports items sold as 2014 World Cup merchandise by Nike, Adidas and Puma. These items are mainly produced in Asia (China, Indonesia, Vietnam), but also in eastern Europe and Argentina.

# Policies

9. **TỔNG CỤC MÔI TRƯỜNG (MONRE): Hướng dẫn kỹ thuật kiểm kê, quản lý an toàn và kiểm soát rủi ro đối với perfluorooctance sulfonic axit, các muối và perfluorooctance sulfonyl fluoride (PFOS) (18/06/2014)**

http://vea.gov.vn/CommonPages/DownloadAttachment.aspx?ListName=VanBanQPPL&FileName=4.%20Huong%20dan%20ky%20thuat%20PFOS.doc&ItemID=9252

Guidance on inventory techniques, safety management and risk control for perfluorooctance sulfonic acid, salts and perfluorooctance sulfonyl fluoride from the General Department of Environment

# Scientific studies

10. **GREENPEACE (2014) A Red Card for sportswear brands - Hazardous chemicals found in World Cup merchandise**

https://www.greenpeace.de/sites/www.greenpeace.de/files/detox_2014_11_englisch.pdf

This study follows several previous investigations published by Greenpeace as part of its Detox campaign, which identified hazardous chemicals present in textile and leather products as a result of their use during manufacture. This is the first study that specifically focused on football kit; the products bought were all manufactured and sold as part of the World Cup 2014 tournament, which took place in Brazil between June 12th and July 13th 2014.

The marketing of football shirts, boots and other accessories connected with the World Cup is a multi-billion dollar market, worth more than $5 billion annually; the top two brands – Adidas and Nike – share upwards of 80 percent of the market for many soccer products. Record sales of football products are expected in 2014. For this investigation, a total of thirty-three products – including twenty-one pairs of football boots, seven football shirts, four pairs of goalkeeper's gloves and one ball – were bought from sixteen different countries/regions around the world: Argentina, Chile, China, Croatia, Germany, Hong Kong, Indonesia, Italy, Mexico, Netherlands, Russia, South Korea, Spain, Switzerland, Taiwan and the UK. Twenty of the products were manufactured specifically for children of various ages.

The three major sportswear brands were all represented, with sixteen products from adidas, fifteen from Nike and two from Puma. All of the products were branded either with the names of famous footballers or the national teams playing in the World Cup 2014. They were purchased either directly from the brand's stores – retail or online – or from well-known sports retailers. Most of the products were manufactured in either China or Indonesia with lesser quantities made in Vietnam, Cambodia, Bangladesh, Thailand, Argentina, Bosnia, Georgia and the Ukraine.

The products were sent to the Greenpeace Research Laboratories at the University of Exeter in the UK and a duplicate was sent to Greenpeace Germany. From there they were dispatched to independent accredited laboratories. The football boots and gloves were investigated for the presence of perfluorinated chemicals (PFCs); all of the products were analysed for nonylphenol ethoxylates (NPEs) and phthalates, and the football boots and ball were analysed for dimethylformamide (DMF). This is the first time that Greenpeace has investigated products for the presence of DMF. For certain products, analysis was also carried out for organotins and antimony.

11. **NORSK INSTITUTT FOR LUFTFORSKNING (NILU): Investigation of outdoor textiles with respect to determine the content of ionic perfluorinated substances (PFASs) (1/6/2014)**

https://www.miljodirektoratet.no/Documents/publikasjoner/M306/M306.pdf

NILU has, on behalf of the Norwegian Environment Agency, determined the concentration of ionic perfluorinated substances (PFASs), including PFOA, in outdoor clothing. Of the investigated 12 items, PFAS was only detected in 2 of the items. Four samples contained PFOA exceeding the limit of 1 µg/m$^2$. The quality assurance where three replicates of one sample were extracted had a relative standard deviation (RSD) of less than 10% for all detected substances except one (PFTrDA). Other quality measures such as recovery calculations and blanks, show that the method used for extraction is suitable for these types of matrixes and substances. PFOS was not present in any of the items investigated, indicating that the textile industry manages to effectively avoid PFOS in production processes. According to the statistics in the report, Vietnam has 02 outdoor clothing samples that were purchased by the Norwegian Environment Agency and shipped to NILU for analysis.

12. **UMWELTBUNDESAMT: Understanding the exposure pathways of per- and polyfluoralkyl substances (PFASs) via use of PFASs-containing products – risk estimation for man and environment (7/2014)**

http://www.waterresources.at/fileadmin/user_uploads/Publications/van_Driezum_UBA_report_2014.pdf

The contribution of outdoor jackets as a source of per- and polyfluoroalkyl substances (PFASs) regarding the environmental and human exposure in Germany and other member states of the European Union (EU) has been investigated. Following the development of robust and validated analytical methods for 24 different PFASs, a total of five impregnating agents and 16 different jackets were analyzed. Jackets were selected depending on e.g. their origin of production, textile, price and market share.

In these jackets PFASs were determined in a range between 0.03 and 719 µg/m2. In particular perfluorooctanoic acid (PFOA) was omnipresent (0.02 to 171 µg/m2), although at lower concentrations compared to the precursors of perfluoroalkyl carboxylic acids (PFCAs), namely fluorotelomer alcohols (FTOHs) (< 1 ng/m2 to 698 µg/m2). Perfluoroalkane sulfonic acids (PFSAs) and their potential precursors, such as e.g. perfluorooctane sulfonamide (FOSA), were detected at a much lower frequency with concentration up to 5 µg/m2.

Environmental exposure routes of PFASs from both, newly bought and freshly impregnated jackets were studied. In particular air emission of volatile PFASs precursors, such as 8:2- and 10:2-FTOH could be quantified; however additional losses having already occurred during storing of the jackets have been postulated. Also, the release of PFCAs during washing could be quantified. The detected PFOA concentrations in washing water indicated a complete release of the extractable PFOA amount.

Quantification of the human exposure to PFASs stemming from outdoor jackets showed, that the highest intermediate exposure for the background population was observed for PFOA (0.054 ng kg-1 day-1). This is a factor 3-10 lower than the estimated average intake via diet. However, for populations receiving an occupational exposure in outdoor clothing stores, exposure to outdoor jackets could exceed dietary intake estimates. Estimating the worst-case scenario for Germany, a surplus in the import of approximately 80 Million PFASs-containing outdoor jackets, these jackets do contribute with an amount of 0.27 kg PFOA as one particular source among many others to the PFASs burden for people and the aquatic environment.

Production of highest quality garments is mostly done in Asian countries, especially in the Far East, like China and Vietnam. Manufacturing in Germany and the EU is negligible due to higher manufacturing costs within these countries and production sites in the Far East are superior to most European sites, being too old fashioned. Long-term contracts with production sites in the Far East ensure a high knowledge, a good training for employees, modern facilities and a proper work environment. According

to the statistics in the report, Vietnam has 03 outdoor jacket samples and 07 companies involved in the textile production for Patagonia.

13. **SCIENCEDIRECT: Lan-Anh Phan Thi, Huu-Tuan Do, Shang-Lien Lo: Enhancing decomposition rate of perfluorooctanoic acid by carbonate radical assisted sonochemical treatment (9/2014)**

https://www.sciencedirect.com/science/article/pii/S1350417714001175?via%3Dihub

The research about PFOA was conducted by a group of Vietnamese and China authors. Perfluorooctanoic acid (PFOA) is a recalcitrant organic pollutant in wastewater because of its wide range of applications. Technologies for PFOA treatment have recently been developed. In this study, PFOA decomposition by sonochemical treatment was investigated to determine the effects of $NaHCO_3$ concentrations, $N_2$ saturation, and pH on decomposition rates and defluorination efficiencies. The results showed that PFOA decomposition by ultrasound treatment only (150 W, 40 kHz), with or without saturated $N_2$, was <25% after 4 h reaction. The extent and rate of PFOA decomposition and defluorination efficiencies of PFOA, however, greatly increased with the addition of carbonate radical reagents. PFOA was completely decomposed after 4 h of sonochemical treatment with a carbonate radical oxidant and saturated $N_2$. Without saturated $N_2$, PFOA was also decomposed to a high (98.81%) degree. The highest PFOA decomposition and defluorination efficiencies occurred in $N_2$ saturated solution containing an initial $NaHCO_3$ concentration of 30 mM. Sonode composition of PFOA with $CO_3^-$ radical was most favorable in a slightly alkaline environment (pH = 8.65). No shorter-chain perfluorinated carboxylic acids were detected except fluorine ions in final reaction solution.

14. **GREENPEACE: A Red Card for sportswear brands (11/2014)**

https://www.greenpeace.de/sites/www.greenpeace.de/files/detox_2014_11_englisch.pdf

This study follows on from several previous investigations published by Greenpeace as part of its Detox campaign, which identified that hazardous chemicals are present in textile and leather products as a result of their use during manufacture. This is the first study that has specifically focussed on football kit; the products bought were all manufactured and sold as part of the World Cup 2014 tournament, taking place in Brazil between June 12th and July 13th 2014. The three major sportswear brands were all represented, with sixteen products from Adidas, fifteen from Nike and two from Puma. All of the products were branded either with the names of famous footballers or the national teams playing in the World Cup 2014. They were purchased either directly from the brand's stores – retail or online – or from well-known sports retailers. Most of the products were manufactured in either China or Indonesia with lesser quantities made in Vietnam, Cambodia, Bangladesh, Thailand, Argentina, Bosnia, Georgia and the Ukraine.

# 2015

## Newspapers

### VIETNAMESE

1. **NGƯỜI LAO ĐỘNG: Chấm dứt sử dụng chất chống dính chứa PFOA (08/02/2015)**

https://nld.com.vn/doanh-nghiep/2015-cham-dut-su-dung-chat-chong-dinh-chua-pfoa-20150208190204465.htm

2. **VNEXPRESS: Nguy cơ bệnh tật từ chất chống dính cho nồi, chảo (04/03/2015)**

http://doisong.vnexpress.net/tin-tuc/suc-khoe/tu-van/nguy-co-benh-tat-tu-chat-chong-dinh-cho-noi-chao-3152644.html

(Republish): https://mav.vn/10-tac-hai-cua-noi-chao-chong-dinh/

3. **VIETQ: Nồi chảo chống dính chất lượng kém có khả năng gây ung thư (07/03/2015)**

http://vietq.vn/noi-chao-chong-dinh-chat-luong-kem-co-kha-nang-gay-ung-thu-d55188.html
(Republish)https://www.tinmoi.vn/noi-chao-chong-dinh-chat-luong-kem-co-kha-nang-gay-ung-thu-011348114.html
(Republish)https://baomoi.com/noi-chao-chong-dinh-chat-luong-kem-co-kha-nang-gay-ung-thu/c/16095636.epi

4. **BÁO LAO ĐỘNG: 10 tác hại không ngờ của chất chống dính ở nồi chảo (09/03/2015)**

https://laodong.vn/suc-khoe/10-tac-hai-khong-ngo-cua-chat-chong-dinh-o-noi-chao-302792.bld
(Republish)http://soha.vn/song-khoe/10-tac-hai-khong-ngo-cua-chat-chong-dinh-o-noi-chao-20150309203140875.htm

5. **ZING NEWS: 7 đồ vật trong nhà tiềm ẩn nguy cơ gây ung thư (24/04/2015)**

https://news.zing.vn/7-do-vat-trong-nha-tiem-an-nguy-co-gay-ung-thu-post533377.html

6. **GIÁO DỤC VIỆT NAM: 10 vật dụng trong nhà có nguy cơ chứa chất gây ung thư (09/05/2015)**

http://giaoduc.net.vn/Suc-khoe/10-vat-dung-trong-nha-co-nguy-co-chua-chat-gay-ung-thu-post158081.gd

7. **TINHHOA: 10 thứ bạn phải vứt bỏ để có sức khỏe tốt hơn (25/09/2015)**

http://tinhhoa.net/10-thu-ban-phai-vut-bo-de-co-suc-khoe-tot-hon.html

8. **SOHA: 11 món đồ gia dụng tiềm ẩn nguy cơ gây ung thư (11/11/2015)**

http://soha.vn/song-khoe/11-mon-do-gia-dung-tiem-an-nguy-co-gay-ung-thu-20151111103714356.htm

9. **TIÊU DÙNG: Dụng cụ nhà bếp là thủ phạm gây hại cho sức khỏe (12/12/2015)**

http://tieudungplus.vn/dung-cu-nha-bep-la-thu-pham-gay-hai-cho-suc-khoe-6093.html

All the articles above warn about the potential risks of non-stick pots and pans for human health such as thyroid failure, cognitive disorders, cancer, heart attack, infertility . In addition, they recommend housewives to choose good quality nonstick pans, use them properly and remove them from use when peeling occurs.

10. **ĐỜI SỐNG VÀ PHÁP LUẬT: Những thực phẩm gây ung thư mà bạn vẫn ăn hàng ngày (02/07/2015)**

http://www.doisongphapluat.com/doi-song/suc-khoe-lam-dep/nhung-thuc-pham-gay-ung-thu-ma-ban-van-an-hang-ngay-a100454.html

11. **GIÁO DỤC VIỆT NAM: Những thực phẩm hàng ngày có thể gây ung thư (31/08/2015)**

http://giaoduc.net.vn/Suc-khoe/Nhung-thuc-pham-hang-ngay-co-the-gay-ung-thu-post161363.gd
(Republish)http://www.xaluan.com/modules.php?name=News&file=article&sid=1239261

12. **VIETNAMNET: 8 loại thực phẩm có khả năng gây ung thư cao nhất (26/10/2015)**

https://vietnamnet.vn/vn/doi-song/8-loai-thuc-pham-co-kha-nang-gay-ung-thu-cao-nhat-269729.html

13. **VIETNAMNET: 10 thực phẩm thà chết cũng không nên ăn (18/11/2015)**

https://vietnamnet.vn/vn/khoa-hoc/10-thuc-pham-tha-chet-cung-khong-nen-an-273730.html

14. **VOV: Các loại thực phẩm không nên ăn khi đói (22/11/2015)**

https://vov.vn/suc-khoe/cac-loai-thuc-pham-khong-nen-an-khi-doi-452620.vov

15. **OHAY TV: Top 10 thực phẩm gây ung thư bạn nên tránh (05/12/2015)**

https://www.ohay.tv/view/top-10-thuc-pham-gay-ung-thu-ban-nen-tranh/ao2SX

16. **NGÀY NAY: 25 loại thực phẩm "kịch độc" thà chết cũng không ăn (23/12/2015)**

https://ngaynay.vn/suc-khoe/25-loai-thuc-pham-kich-doc-tha-chet-cung-khong-an-26398.html

All the articles above point out that daily foods can be enemies for health, especially processed and canned foods.

# Scientific studies

## VIETNAMESE

17. **COLUMBIA SPORTSWEAR COMPANY: Danh Mục Các Chất Bị Hạn Chế (RSL) và Sổ Tay An Toàn Sản Phẩm (01/07/2015)**

http://www.columbiasportswear.ca/on/demandware.static/-/Sites-Columbia_CA-Library/default/dw57a122ef/AboutUs/PDF/Fall_15/Columbia%20Sportswear%20Company%20RSL%20and%20Product%20Safety%20Manual%20July%202015%20-%20Vietnamese.pdf

This is the Product Safety handbook of Columbia Sportswear Company, a company based in Vietnam. that manufactures and distributes jackets, sportswear and footwear, as well as hats, camping equipment, ski apparel and clothing accessories. This list contains research on restricted substances in the production of the company's products, including perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). These two chemical toxins are the main ingredients in many waterproof coatings, and can be found in bonding agents in nonwoven fabrics, leather and other materials.

## ENGLISH

18. **SCIENCEDIRECT: Duong Thi Hanh, Kiwao Kadokami, Hanako Shirasaka, Rento Hidaka, Hong Thi Cam Chau, Lingxiao Kong, nguyen Quang Trung, Nguyen Thanh Thao: Environmental Research; Reports from Institute of Environmental Technology Advance Knowledge in Environmental Research (Occurrence of perfluoroalkyl acids in environmental waters in Vietnam), (13 March 2015)**

https://www.sciencedirect.com/science/article/pii/S0045653514013411

This is the first nationwide study of perfluoroalkyl acids (PFAAs) in environmental waters in Vietnam. Twenty-eight river water and 22 groundwater samples collected in four major cities and 14 river water samples from the Red River were screened to investigate the occurrence and sources of 16 PFAAs. Perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), and perfluorononanoic acid (PFNA) were the most prevalent of 11 detected PFAAs with maximum concentrations in urban river water of 5.3, 18 and 0.93 ng L−1, respectively, and in groundwater of 8.2, 4.5 and 0.45 ng L−1, respectively. The most frequently detected PFAS in surface water were PFOA (98%), PFNA (84%, and PFOS (59%). PFBA, PFHpA, PFOA, PFNA, PFDA, PFHxS and PFOS were the major PFAS found in ground water with PFOS and PFOA being the most prevalent. In the Red River, the most commonly found PFAS were PFOA, PFNA, PFDA and PFOS. PFAAs in the Red River water were detected but at low levels. PFAA concentrations in river water were higher in the rainy season than in the dry season, possibly due to storm water runoff, a common phenomenon in Southeast Asian countries. The highest concentrations of PFAAs in river water were observed in samples from highly populated and industrialized areas, perhaps sourced from sewage. The PFAA concentrations observed were similar to those in other Southeast Asian countries, but lower than in developed nations. From the composition profiles of PFAAs, industrial products containing PFAAs imported from China and Japan might be one of the major sources of PFAAs in the Vietnamese aquatic environment. According to the health-based values and advisory issued by the United States Environmental Protection Agency (USEPA), the concentrations of detected PFAAs in this study do not pose an immediate health risk to humans and aquatic organisms. However, individual US states have enacted stricter regulations on PFAS substances in drinking water due to updated scientific assessments of harm. For example, the US state of Vermont sets a drinking water health advisory limit of 20 ppt for PFOA, PFOS, PFHxS, PFHpA and PFNA combined. The authors noted that the high detection frequencies of PFOS and PFOA, “demonstrated that these chemicals are ubiquitous in the Vietnamese urban aquatic environment…”

19. **DISABLED WORLD (THOMAS C. WEISS): Electronic Waste: Medical and Health Issues (21/5/2015)**

https://www.disabled-world.com/health/ewaste.php

The use of electrical and electronic equipment (EEE) is rising and the amount of electrical and electronic waste or, 'e-waste,' produced every day is growing at an incredible rate around the world.

Electronic waste or e-waste is defined as discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling or disposal are also described as e-waste. Informal processing of electronic waste in developing countries may cause serious health and pollution problems, as these countries have limited regulatory oversight of e-waste processing. Recycling of valuable elements contained in e-waste such as gold or copper has become a source of income, largely in the informal sector of emerging or developing industrialized countries. Primitive recycling techniques; however, such as burning or retaining the copper expose child and adult workers as well as their family members to a number of hazardous substances.

20. **UNIVERSITY OF KITAKYUSHU: Dương Thị Hạnh: Occurrence of organic micro-pollutants in the aquatic environment in Vietnam (September 2015)**

https://kitakyu.repo.nii.ac.jp/index.phpaction=repository_action_common_download&item_id=468&item_no=1&attribute_id=20&file_no=1&page_id=13&block_id=256

This study attempts to paint a more detailed picture of anthropogenic chemicals in aquatic environment throughout Vietnam by applying comprehensive analytical methods that utilize a comprehensive gas chromatography–mass spectrometry – database, which allows automatic identification and quantification of 940 organic micro-pollutants (OMPs) in environmental samples (waters and sediments). In addition, an investigation of 16 perfluoroalkyl acids (PFAAs) in environmental waters in Vietnam that involved the application of high-performance liquid chromatography tandem mass spectrometry was carried out. Hundreds of OMPs at high concentrations were detected in waters and sediments. Moreover, the pollution characteristics, potential pollution sources as well as the potential risk of detected contaminants were clarified.

# 2016

## Newspapers

### VIETNAMESE

1. **BÁO QUỐC TẾ: 7 loại thực phẩm có hại cho sức khỏe trong năm 2016 (12/01/2016)**

http://baoquocte.vn/7-loai-thuc-pham-co-hai-cho-suc-khoe-trong-nam-2016-26626.html

2. **KIẾN THỨC: Tường tận tác hại của bắp rang lò vi sóng (16/01/2016)**

https://kienthuc.net.vn/khoe-dep/tuong-tan-tac-hai-cua-bap-rang-lo-vi-song-619917.html
(Republish) https://www.yan.vn/tuong-tan-tac-hai-cua-bap-rang-lo-vi-song-78597.html

3. **SOHA: Cảnh giác với món "khoái khẩu" có thể gây ung thư và đột quỵ này (17/01/2016)**

http://soha.vn/song-khoe/canh-giac-voi-mon-khoai-khau-co-the-gay-ung-thu-va-dot-quy-nay-20160116231320762.htm
(Republish)http://cafebiz.vn/song/bap-rang-bo-mon-khoai-khau-co-the-gay-ung-thu-va-dot-quy-20160117142803132.chn

4. **HÀ NỘI MỚI: 10 loại thực phẩm càng ăn càng dễ chết (18/09/2016)**

http://hanoimoi.com.vn/tin-tuc/Suc-khoe/848628/10-loai-thuc-pham-cang-an-cang-de-chet
(Republish)http://www.baodienbienphu.com.vn/tin-tuc/suc-khoe/148495/10-loai-thuc-pham-cang-an-cang-de-chet

5. **PHỤ NỮ KIỀU VIỆT: Giật mình với 10 loại thực phẩm gây ung thư trong bữa ăn hằng ngày (08/07/2016)**

https://www.phunukieuviet.com/ung-thu/giat-minh-voi-10-loai-thuc-pham-gay-ung-thu-trong-bua-an-hang-ngay.html

6. **VNMEDIA: Những thực phẩm hàng ngày vô cùng độc hại nên tránh xa (03/08/2016)**

http://vnmedia.vn/thi-truong/201608/nhung-thuc-pham-hang-ngay-vo-cung-doc-hai-nen-tranh-xa-538100/

(Republish)http://saovui.net/10-loai-thuc-pham-chac-chan-gay-ung-thu-gan-ban-can-tranh-xa-16903.html

7. **TIÊU DÙNG PLUS: Để không yếu tim và ung thư, cần tránh xa những loại thực phẩm này! (04/08/2016)**

http://tieudungplus.vn/de-khong-yeu-tim-va-ung-thu-can-tranh-xa-nhung-loai-thuc-pham-nay-12041.html

8. **VIETNAMNET: Lánh xa 8 thực phẩm này nếu không muốn mắc ung thư (29/09/2016)**

https://vietnamnet.vn/vn/suc-khoe/an-toan-thuc-pham/phong-tranh-ung-thu-lanh-xa-8-thuc-pham-de-tranh-ung-thu-329969.html

The articles list some harmful foods, all of which mention popcorn, a popular dish made with a microwave. Not only does it contain fats, preservatives, etc., this food is also harmful to health because they are usually lined with a chemical called perfluorooctanoic acid (PFOA). This substance is considered possibly carcinogenic by the US Environmental Protection Agency (EPA) and according to a recent study by the University of California, PFOA can lead to infertility in women.

9. **TIN TỨC ONLINE: 7 đồ dùng quen thuộc nhưng cực nguy hiểm trong nhà (11/03/2016)**

https://tintuconline.com.vn/suc-khoe/7-do-dung-quen-thuoc-nhung-cuc-nguy-hiem-trong-nha--n-261026.html

The article lists some familiar items that could contain PFAS substances and be dangerous in every family, such as pizza boxes, beverage covers and candy wrappers. Perfluorooctanoic acid (PFOA) chemicals in these shells are all associated with an increased risk of kidney cancer, testicular cancer, thyroid disease, and even birth defects.

10. **TIÊU CHUẨN VIỆT NAM - HIỆP HỘI DA GIÀY, TÚI XÁCH VIỆT NAM: Các chất bị cấm hoặc hạn chế sử dụng cho nguyên phụ liệu và sản phẩm da giầy: mục đích sử dụng, tác hại và nguy cơ tiềm ẩn (05/09/2016)**

The article mentions some substances that are banned or restricted for use in footwear materials and products, including APEOs / AP, NPEO, OPEO, NP, OP, and BPA, among others.

11. **TRÍ THỨC TRẺ: Hóa chất độc hại, gây ung thư ẩn nấp trong bụi của 90% hộ gia đình: Làm thế nào để phòng tránh? (18/09/2016)**

(Republish)http://cafef.vn/hoa-chat-doc-hai-gay-ung-thu-an-nap-trong-bui-cua-90-ho-gia-dinh-lam-the-nao-de-phong-tranh-20160918000108537.chn

The research by George Washington University (USA) showed that 45 toxic chemicals were found mainly hidden in dust and 10 of them are latent in 90% of households, such as PFOA and PFOS found in cell phones, pizza boxes, waterproof and hard-to-scratch products. They affect the immune, digestive and endocrine systems.

12. **BỘ CÔNG THƯƠNG: Công ước Stockholm về các chất ô nhiễm hữu cơ khó phân hủy (14/10/2016)**

http://csdl.vinachemia.gov.vn/default.aspx?page=news&do=detail&id=480

The article provides information of the history, content and purpose of the Stockholm Convention. Stockholm Convention was signed on May 22, 2001 in Stockholm and took effect from May 17, 2004. Vietnam ratified the Stockholm Convention on persistent organic pollutants on July 22, 2002, and became the 14th Party to the Convention.

13. **THANH NIÊN: 8 loại hóa chất ảnh hưởng đến 'chuyện ấy' của đàn ông (13/08/2016)**

https://thanhnien.vn/suc-khoe/8-loai-hoa-chat-anh-huong-den-chuyen-ay-cua-dan-ong-733419.html

The article names eight chemicals that affect male fertility / sexuality, including perfluorooctanoic acid (PFOA). Research shows that PFOA can stay in the body for years and cause cancer, thyroid disorders and high cholesterol level. It is found in non-stick coating, popcorn bags, fast food wrappers ...

14. **KHỎE VÀ ĐẸP: 4 điều phải biết trong cuộc sống để tránh được bệnh ung thư, (21/03/2016)**

(Republish) https://ngoisao.vn/suc-khoe/cham-soc-suc-khoe/4-dieu-phai-biet-trong-cuoc-song-de-tranh-duoc-benh-ung-thu-199185.htm

15. **VIETQ: Đừng ham chảo chống dính rẻ tiền, cẩn thận kẻo bị ung thư, sảy thai (24/10/2016)**

http://vietq.vn/nguy-co-bi-ngo-doc-tu-nhung-chiec-chao-chong-dinh-re-tien-d106366.html

Both articles emphasize that poor quality anti-stick products should be avoid because of the teflon non-stick coating (the commercial name of two PTFE and PFOA compounds) will be corroded over time, easily scratched with strong contact, harmful to health.

# Scientific studies

## VIETNAMESE

16. **ĐẠI HỌC QUỐC GIA HÀ NỘI - Luận văn Thạc sĩ của Phùng Thị Vĩ (Khoa Môi trường – ĐHKHTN): Khảo sát và đánh giá nguy cơ ô nhiễm các hợp chất Flo hữu cơ (PFCs) trong nước và trầm tích tại một số làng nghề dệt nhuộm, tái chế giấy, nhựa (May, 2016)**

http://hus.vnu.edu.vn/files/LuanVan/LuanVan-PhungThiVi-2016.pdf

This document is the Master's Degree thesis of Phung Thi Vi, Faculty of Environment, University of Natural Sciences (Vietnam National University, Hanoi) on the topic of surveying and evaluating the risk of pollution by organic fluoride contamination (PFCs) in water and sediment in textile and dyeing villages. In particular, the author devoted a chapter to assess the movement of PFOA and PFOS compounds from water into sediments. The thesis is implemented in the framework of the project, "Monitoring and management of persistent organic pollutants (POPs) in Asia" based on the cooperation between CETASD Center and UN University, Japan.

## ENGLISH

17. **KYOTO UNIVERSITY: Dinh Quang Hung: Development of a Rapid and Easy Measurement Protocol for Perfluorinated Carboxylic Acids (PFCAs) by a Continuous Flow Analysis (25/01/2016)**

https://repository.kulib.kyoto-u.ac.jp/dspace/bitstream/2433/204596/2/dtikk00145.pdf

Water contamination by perfluorinated compounds (PFCs) is a major environmental issue. These compounds are considered as persistent, toxic, and bio-accumulated chemicals and are widespread in the environment. The stability of these chemicals makes them difficult to be treated by conventional wastewater and water treatment processes. Reports on PFCs in water environments and industries related to PFCs are limited since the current analytical methods are extremely expensive.

Therefore, it is essential to develop a fast and easy measurement protocol for these compounds. One possible method is a continuous flow analysis, which would measure fluoride ions by a colorimetric method after PFCs decomposition, using AutoAnalyzer 3. Six kinds of PFCAs (PFBA, PFPA, PFHxA, PFHpA, PFOA, and PFNA) were selected for this research. The analytical system consisted of five parts: an auto sampler, a decomposition unit, a distillation unit, a detection unit, and a peristaltic pump. This study selected Da Nang, Vietnam, for investigating PFC concentrations in drinking water, surface water,

and wastewater. The level of PFC concentration found in Da Nang was used for the development of an experimental system for the continuous flow analysis of PFCs. A field survey was conducted from July 30 to August 3, 2011, to collect water samples. Among five tap water samples, TW1 (52 ng/L) had the highest PFC content. PFOA was predominant and its concentration was from 2 to 40 ng/L. For 18 surface water samples, SW8 had the highest concentration (132 ng/L) followed by SW7 (128 ng/L). For samples from two DWWTPs (Phu Loc and Hoa Cuong), two IWWTPs (Hoa Khanh and Tho Quang), and a landfill site (New Khanh Son Landfill), the highest PFCs concentration was founded at the landfill site. Total PFC concentrations in the leachate, mixture of leachate and septic wastewater and treated effluent from the landfill site were 200 ng/L, 516 ng/L, and 75 ng/L, respectively. PFC concentrations from IWWTPs were from 42 to 63 ng/L. However, a high PFC concentration (292 ng/L) was found in the discharging channel of an industrial zone (IZ), which indicated that some industrial factories discharged their wastewater with high PFC concentration into the drainage system without proper treatment. Thus, industrial activities are the major source of PFC contamination in the water in Da Nang.

18. **UNEP: Consolidated guidance on alternatives to perfluorooctane sulfonic acid and its related chemicals (14/10/2016)**

https://www.informea.org/sites/default/files/imported-documents/UNEP-POPS-POPRC.12-INF-15-Rev.1.English.pdf

The present document is a status report based on available information on alternatives to perfluorooctane sulfonic acid (PFOS) and its related chemicals from various sources. It is important to note that data gaps remain with regard to potential alternatives to PFOS and its related chemicals. The data presented in the document are indicative with respect to possible alternatives and it is important that research continue with the aim of to identify possible alternatives and their risks. Concerning the hazards and risks of the identified alternatives, the document responds to specific issues related to the Stockholm Convention and does not address issues unrelated to persistent organic pollutants.

19. **AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE UK LIMITED: Assessment of the continued need for PFOS, Salts of PFOS and PFOS-F (acceptable purposes and specific exemptions), final report (November/2016)**

https://circabc.europa.eu/webdav/CircaBC/env/pop/Library/01-meetings_authorities/16%20-%2016th%20Competent%20Authorities%20meeting%20on%20POPs%20-%2030%20May%202017/02%20-%20Documents/POP-CA_05-17_13-PFOS_EU_Annex-A.pdf

Under the Stockholm Convention perfluorooctanesulphonic acid (PFOS), its salts and perfluorooctanesulfonyl fluoride (PFOSF) are listed in Annex B (restriction). The following acceptable purposes (no time limits) and specific exemptions (time limited) regarding the use of PFOS, its salts and PFOSF are granted according to Decision SC-4/171.

20. **AMERICAN CHEMICAL SOCIETY: Nguyen Hung Minh, Duong Hong Anh, Tran Manh Tri, Hoang Quoc Anh, Pham Thi Ngoc Mai, Vu Duc Nam, Pham Hung Viet, and Tu Binh Minh: Persistent Toxic Substances in Vietnam: A Review of Environmental Contamination and Human Exposure (7/12/2016)**

https://pubs.acs.org/doi/abs/10.1021/bk-2016-1243.ch003

This chapter provides an overview of studies conducted during the last two decades on the environmental contamination and human exposure of persistent toxic substances (PTS) from classic legacy compounds to emerging contaminants, and the emission of unintentionally produced chemicals derived from industrial sectors.

While the contamination of classic persistent organic pollutants (POPs) such as organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) exhibited relatively low levels as a result of long-term and effective ban, elevated residues were still encountered in some locations within densely populated metropolitans and industrialized areas such as Hanoi, Hochiminh city and Bien Hoa - Dong

Nai industrial zone. A number of recent systematic investigations have also highlighted several hotspots of pollution with elevated concentrations of various PTS groups. In this context, open landfill dumping sites for municipal wastes and trade villages with informal recycling practices such as e-waste dismantling are remarkable sources of toxic contaminants and their high emission potential has been quantitatively demonstrated.

A high degree of environmental contamination and human exposure to polybrominated diphenyl ethers (PBDEs) has been reported in some informal e-waste recycling trade villages in northern Vietnam. In addition, the presence of new and emerging chemicals such as organophosphorous flame retardants, polybrominated dibenzo-p-dioxins and dibenzofurans (PBDD/Fs) in e-waste recycling sites further substantiated the importance of those recycling areas in terms of posing high risk to human health and natural ecosystem.

Polychlorianted dibenzo-p-dioxins and furans (PCDD/Fs) contamination derived from Agent Orange (AO) exhibited considerable decreasing trends in sediments and soils at AO/dioxin contaminated hotspot areas, as a result of three decades of remediation efforts. However, newly identified sites within the former Airbases in Da Nang and Bien Hoa were still highly contaminated with dioxins and related compounds. Preliminary surveys for unintentionally produced PCDD/Fs and polychlorobenzene compounds [pentachlorobenzene (PeCB) and hexachlorobenzene (HCB)] indicated that waste incineration, steel making and cement production in Vietnam are potential sectors with relatively high emission levels as compared to other countries in the world.

Human exposure studies have emphasized the importance of non-dietary exposure pathways such as dust ingestion and air inhalation with relatively high contribution to total intakes, particularly for children as a more susceptible group. Future studies should be focused on the systematic time trends and toxic impacts of PTS in the above pollution hotspots in order to explore preventive measures towards protecting human health and ecosystems.

### 21. ACTA UNIVERSITATIS OULUENSIS: Bone as a target for persistent organic pollutants (16/12/2016)

http://jultika.oulu.fi/files/isbn9789526214306.pdf

Persistent organic pollutants (POPs) are ubiquitous and bioaccumulative man-made chemicals, resistant to chemical, biological and photolytic degradation and widely distributed to sediments, wildlife, and human. Many of these chemicals have adverse effects on a variety of targets, including the endocrine system, organogenesis and reproduction. Due to these effects and wide distribution, many of them are either banned or strictly controlled. However, because of persistency, they continue to interact with organisms globally. Despite the existing knowledge of the adverse effects of POPs, the effects of many chemicals on bone tissue are still poorly known.

In the present study, we investigated the adverse effects of three common POPs, including tributyltin (TBT), 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and perfluorooctanoic acid (PFOA) on the skeletal system. In vitro models were used to study the effects of PFOA in mouse and in human, and the co-effects of TBT and TCDD on differentiating osteoblasts and osteoclasts of mice. An in vivo model for mice was used to study the developmental effects of maternal PFOA-exposure on pups among with morphometrical and biomechanical property analyses. Mass-spectrometry was used to study the presence of PFOA in bones both in mice and in human, the latter acquired from the bone bank held in the Oulu University Hospital, Finland. The bones were also analyzed with cone beam computer tomography and microcomputer tomography.

The results show that PFOA exposure in utero and during lactation leads to the accumulation of PFOA in bone, traceable even 17 months after exposure. PFOA exposure decreased the mineral density of the tibias and increased the medullary area. Nearly all of the human samples contained PFAS, including PFOA. PFOA also disturbed the differentiation of osteoblasts and with lower doses, increased bone resorption of osteoclasts both in mouse and human, the phenomenon being slightly stronger in mice. Co-

exposure to TBT and TCDD led to decreased differentiation of osteoblasts and osteoclast, and the co-effect was partially synergistic in osteoblasts. These results show disruption of bone development, bone cell differentiation, and PFAS accumulation in bone. Further studies are recommended to evaluate the co-effects of different POPs and the possible effects of long-term accumulation of POPs in bone and other tissues.

# 2017

# Newspapers

## VIETNAMESE

1. **TIN TỨC ONLINE: Giật mình những dụng cụ nhà bếp chứa độc tố chết người (20/02/2017)**

https://tintuconline.com.vn/suc-khoe/canh-bao-giat-minh-nhung-dung-cu-nha-bep-chua-doc-to-chet-nguoi--n-299201.html

The article warns that perfluorooctanoic acid (PFOA) - a chemical present in non-stick cookware - can seep into food and enter into our bodies, causes many health problems such as weight gain, infertility, learning disabilities in children and cancer.

2. **TRI THỨC: Chảo chống dính: Lợi, hại và những lưu ý khi sử dụng (05/01/2017)**

https://trithucvn.net/suc-khoe/chao-chong-dinh-dung-khong-kheo-se-keo-theo-benh-tat.html

The article tells about the benefits and harms of non-stick pans and how to use the pans safety.

3. **TẾ VIỆT NAM: Hiểm họa ung thư từ giấy gói thức ăn nhanh vô cùng nguy hiểm (03/02/2017)**

http://ytevietnam.edu.vn/hiem-hoa-ung-thu-tu-giay-goi-thuc-an-nhanh-vo-cung-nguy-hiem.html

4. **VIETQ: Nguy hiểm chết người từ 5 loại giấy gói thức ăn nhanh (03/02/2017)**
http://vietq.vn/nguy-hiem-chet-nguoi-tu-5-loai-giay-goi-thuc-an-nhanh-d114181.html
(Republish) https://antoanthucpham.org/nguy-hiem-chet-nguoi-tu-5-loai-giay-goi-thuc-an-nhanh/
(Republish) https://baomoi.com/nguy-hiem-chet-nguoi-tu-5-loai-giay-goi-thuc-an-nhanh/c/21450222.epi

5. **PHÁP LUẬT HCM: Hiểm hoạ hoá chất từ giấy gói thức ăn nhanh (03/02/2017)**
(Republish) https://dantri.com.vn/suc-khoe/hiem-hoa-hoa-chat-tu-giay-goi-thuc-an-nhanh-20170203071439631.htm

6. **KHỎE 365: Cảnh báo bao đựng thức ăn nhanh có chứa chất cực độc (10/02/2017)**
http://khoe365.net.vn/canh-bao-bao-dung-thuc-an-nhanh-co-chua-chat-cuc-doc-40016.htm

7. **VIETNAMNET: Rước độc vào thân từ giấy gói đồ ăn nhanh, 20/02/2017**
https://vietnamnet.vn/vn/suc-khoe/an-toan-thuc-pham/ruoc-doc-vao-than-tu-giay-goi-do-an-nhanh-357073.html

8. **BLOGANCHOI: 13 thủ phạm gây ung thư tồn tại hàng ngày quanh ta (27/10/2017)**
https://bloganchoi.com/thu-pham-gay-ung-thu-ton-tai-hang-ngay-quanh-ta/#gsc.tab=0
The articles inform about perfluorinated chemicals (PFCs) that are often used in fast-food packaging. Some PFCs will transform into PFOA when it enters human body, and might lead to health problems and increase the risk of cancer.

9. **VIETQ: Tìm ra giải pháp xử lý nước bị nhiễm PFAS (26/03/2017)**

http://vietq.vn/tim-ra-giai-phap-xu-ly-nuoc-bi-nhiem-pfas-d117997.html

The article provides information about Australian researchers finding a solution for PFAS-contaminated soil or water problems at Australian military bases and airports.

**10. 8. TIN MỚI: 10 món ăn dễ gây nghiện nhưng vô cùng có hại cho sức khỏe (24/03/2017)**
https://www.tinmoi.vn/10-mon-an-de-gay-nghien-nhung-vo-cung-co-hai-cho-suc-khoe-011448087.html

**11. PHÁP LUẬT TP.HCM: 8 thực phẩm "giết chết" cảm hứng yêu đương (03/04/2017)**
https://plo.vn/suc-khoe/dinh-duong/8-thuc-pham-giet-chet-cam-hung-yeu-duong-692808.html

**12. SOHA: Bỏng ngô không gây ung thư, chỉ khi bạn ăn theo cách này mới có hại, (28/05/2017)**
http://soha.vn/bong-ngo-khong-gay-ung-thu-chi-khi-ban-an-theo-cach-nay-moi-co-hai-20170509110650994.htm

**13. GIA ĐÌNH: Những thực phẩm mà các nhà dinh dưỡng khuyên không chạm vào (10/06/2017)**
http://giadinh.net.vn/song-khoe/nhung-thuc-pham-ma-cac-nha-dinh-duong-khuyen-khong-cham-vao-20170610092952395.htm

**14. 19. PHỤ NỮ NGÀY NAY: 9 thói quen thường ngày gây hại cho sức khỏe nhiều người mắc phải (13/12/2017)**
http://www.phunungaynay.vn/am-thuc/9-dieu-chung-toi-lam-moi-ngay-co-the-gay-hai-cho-chung-toi.html

**15. 18. ZING NEWS: 10 loại thực phẩm thường ngày dễ gây ung thư và có hại cho sức khỏe (28/11/2017)**
(Republish) http://thucphamtotnhat.vn/91/1695/10-loai-thuc-pham-thuong-ngay-de-gay-ung-thu-va-co-hai-cho-suc-khoe.html
The articles present a list of foods that nutritionists recommend against eating, and each of them includes microwave popcorn.

**15. VTV NEWS: Cẩn trọng những "ổ" vi khuẩn gây hại trong nhà (26/07/2017)**

https://vtv.vn/doi-song/can-trong-nhung-o-vi-khuan-gay-hai-trong-nha-20170726153120923.htm

Non-stick cookware can contain perfluorooctanoic acid (PFOA), if they are not cleaned clearly, regularly, they can cause liver, thyroid and immunodeficiency diseases.

**16. VOV: Các chất gây hại có thể ảnh hưởng đến sức khoẻ nam giới (22/10/2017)**
https://vov.vn/suc-khoe/nam-khoa/cac-chat-gay-hai-co-the-anh-huong-den-suc-khoe-nam-gioi-685723.vov

(Republish) https://baomoi.com/cac-chat-gay-hai-co-the-anh-huong-den-suc-khoe-nam-gioi/c/23654829.epi
The article lists some chemicals that may adversely affect men's health, including perflurooctanoic acid (PFOA).

**21. TIA SÁNG: 20 năm bền bỉ nghiên cứu về POPs (17/12/2017)**

http://tiasang.com.vn/-khoa-hoc-cong-nghe/20-nam-ben-bi-nghien-cuu-ve-POPs-11084

The article shares the story of Professor. Doctor. Pham Hung Viet, Director of Key Laboratory of Analytical Technology for Environmental Quality and Food Safety Control (University of Science - Vietnam National University) on the process of formation and development of the Laboratory which has had 20 years of persistent research on POPs and related compounds.

# Scientific studies

## VIETNAMESE

22. **NIKE.INC: Danh sách các hóa chất hạn chế sử dụng (RSL) & hướng dẫn về hóa chất bền vững (SCG), (18/01/2017)**

https://s3.amazonaws.com/nikeinc/assets/71188/rsl-vietnamese.pdf?1498171586

Nike's Restricted Substances List (RSL) and Sustainable Chemistry Guidance (SCG) 2017, which includes PFOS.

23. **RESEARCHGATE: Phan Đình Quang, Nguyễn Thúy Ngọc, Phùng Thị Vĩ, Nguyễn Thị Thu Nga, Nguyễn Thị Kim Thủy, Dương Hồng Anh, Phạm Hùng Việt, Lê Hữu Tuyến: Khảo sát hàm lượng các hợp chất peflo hóa (PFCs) trong máu của một số loại cá tại khu vực Hà Nội (26/01/2017)**

https://www.researchgate.net/publication/318983107_Khao_sat_ham_luong_cac_hop_chat_peflo_hoa_PFCs_trong_mau_cua_mot_so_loai_ca_tai_khu_vuc_Ha_Noi

The study of the Vietnamese researchers on the content of perfluorinated compounds (PFCs) in the blood of different types of fish in Hanoi area.

24. **AFIRM: Tài liệu hướng dẫn sử dụng hóa chất - Các hóa chất và trợ chất dệt (27/05/2017)**

http://vietnam12h.com/hinhanh/tailieupdf/27-5-2017-Cac-hoa-chat-va-tro-chat-det.pdf

Afirm's Chemical Information Document – Textile chemicals and auxiliaries.

25. **COLUMBIA SPORTSWEAR COMPANY: Danh Mục Các Chất Bị Hạn Chế (RSL) và Sổ Tay An Toàn Sản PhẩM (07/08/2017)**

https://www.columbia.com/on/demandware.static/-/Sites-Columbia_US-Library/default/dwb5957b44/AboutUs/PDF/2018/Product%20Safety%20Manuals/Columbia%20Sportswear%20Company%20RSL%20and%20Product%20Safety%20Manual%20August%202017%20-%20Vietnamese.pdf

Columbia Sportwear Company: Restricted Substances List (RSL) and Product Safety Manual; Vietnamese Version

26. **THỦ TƯỚNG CHÍNH PHỦ: Quyết định về việc ban hành kế hoạch quốc gia thực hiện công ước Stockholm về các chất ô nhiễm hữu cơ khó phân hủy đến năm 2025, tầm nhìn đến năm 2030 (17/10/2017)**

http://vea.gov.vn/Lists/VanBanQPPL/Attachments/9704/1598-qd-ttg.htm

Decision no. 1598/QD-TTg dated 17 October 2017 on the National plan for the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs) by 2025 with a vision to 2030. According to the implementation plan, the government will work to improve institutional capacity and legal framework for the management and elimination of POPs. It will reinforce its expertise in monitoring, detecting and managing POPs and enhance awareness of the POPs and their harmful effects to the environment among involved parties.

### ENGLISH & GERMAN

27. **ALTERNATIVE FÜR DEUTSCHLAND: PFOA im Landkreis Altötting: AfD-Kreisverband Altötting fordert PFOA-freies Trinkwasser und lückenlose Aufklärung (Update: Bürgerversammlung in Kastl vom 24.11.), (20/11/2017)**

https://xn--altttting-alternativ-s6b.de/pfoa-in-emmerting-stellungnahme-des-kv-aoe-der-afd-zur-buergerversammlung-in-emmerting/

The highest average blood levels were found in Australia and China. In Canada, PFCs were found in three Arctic lakes. In Vietnam, PFCs were found in 98-100% of pregnant Vietnamese women and in Greenland in polar bears. In South Africa, PFOA and PFOS were found in all samples of the largest rivers. In Japan, workers with high levels of PFOA were identified who once worked in DuPont factories.

28. **JOURNAL OF HAZARDOUS MATERIALS: Nguyen Hoang Lam, Chon-Rae Cho, Kurunthachalam Kannan, Hyeon-Seo Cho: A nationwide survey of perfluorinated alkyl substances in waters, sediment and biota collected from aquatic environment in Vietnam: Distributions and bioconcentration profiles (5/2/2017)**

https://www.researchgate.net/publication/300408033_A_nationwide_survey_of_perfluorinated_alkyl_substances_in_waters_sediment_and_biota_collected_from_aquatic_environment_in_Vietnam_Distributions_and_bioconcentration_profiles

This study provides baseline information for a better understanding of PFASs contamination in Vietnam. Water, sediment, various tissues of fish, crustacean, gastropod and bivalve were collected from major river basins in Vietnam and analyzed for the presence of perfluorinated alkyl substances (PFASs). Furthermore, the occurrence of PFASs in coastal, tap and well waters collected from eight different regions in Vietnam was investigated. PFOA and PFOS were consistently detected as the dominant PFASs in surface waters. The greatest concentrations of PFOA (53.5 ng L−1) and PFOS (40.2 ng L−1) were found in a surface water sample collected from a channel that receives wastewater treatment plant discharges. PFOS and PFHxS were found as the predominant PFASs in sediments. The greatest PFAS concentration in biota was 16.9 ng PFUnDA g−1 wet weight found in a fish liver. Some long chain PFCAs including PFNA, PFUnDA and PFTrDA as well as PFHxS were more abundant than short chain PFASs in biota tissues. The measured concentrations of PFOS and PFOA in surface and tap waters were below the provisional health advisory. The rank order of mean bioconcentration factor of PFOS in biota was: crustacean (115 L/kg), gastropod (1117 L/kg), fish (1120 L/kg) and bivalve (2110 L/kg).

29. **ENVIRON SCI TECHNOL: Fangfang Chen, Shanshan Yin, Barry C. Kelly, and Weiping Liu: Isomer-Specific Transplacental Transfer of Perfluoroalkyl Acids: Results from a Survey of Paired Maternal, Cord Sera, and Placentas (16/5/2017)**

https://www.researchgate.net/publication/316439967_Isomer-Specific_Transplacental_Transfer_of_Perfluoroalkyl_Acids_Results_from_a_Survey_of_Paired_Maternal_Cord_Sera_and_Placentas

Currently, information regarding isomer-specific concentrations of PFHxS, PFOS, and PFOA in human placenta, and corresponding placental-maternal ratios (RPM) of these compounds does not exist. The objective of the present study was to assess the occurrence and distribution of different PFHxS, PFOS, and PFOA isomers in maternal serum, umbilical cord serum, and placenta to gain a better understanding of transplacental transport efficiency and prenatal exposure risks. The study involved quantitative determination of isomer-specific concentrations of PFHxS, PFOS, and PFOA in samples of maternal serum (n = 32), cord serum (n = 32), and placenta (n = 32) from pregnant women in Wuhan, China. The results indicate that both linear and branched PFHxS, PFOS and PFOA can be efficiently transported across the placenta, with exposure levels ordered maternal serum > cord serum > placenta. For PFOS isomers, the concentration ratios between cord serum and maternal serum (RCM) were ordered n < iso < 4m < (3 + 5)m < 1m < ∑m2. The RPM values exhibited a similar trend for branched PFOS isomers: iso < 4m ≈ (3 + 5)m < 1m ≈ ∑m2. Conversely, PFOA isomers did not exhibit an obvious structure−activity relationship for RCM and RPM. n-PFHxS transported across the placenta to a greater extent than br-PFHxS. To the best of our knowledge, this is the first study to report the occurrence of PFHxS, PFOS, and PFOA isomers in human placenta. Further, RPM values of these compounds are reported here for the first time. The findings help to better understand the mechanisms of the placental transfer and neonatal exposure to these important contaminants of concern.

30. **EMSA EUROPEAN MARITIME SAFETY AGENCY: Study of two hazardous substances (PFOS and HBCDD) included in the annexes of regulation (EU) 1257/2013 on ship recycling (13/11/2017)**

http://www.emsa.europa.eu/about/download/5034/3168/23.html

Firefighting foam is expected to have the highest concentration of PFOS and the most relevant material to analyse and check for inclusion in the IHM Part I. The amounts on board may be substantial (range 400-19 000 litres). Protective coatings for fabrics such as carpets, textiles, upholstery and electronics such as semiconductors not integral to ship in operation, is also relevant, however falling out of scope with regards to IHM Part I in general. But, for example carpets glued to the floor is considered integral part and should be included in IHM Part 1. Possible content of HBCDD need to be addressed, whenever replaced or when vessel is due for recycling, to ensure safe and environmentally sound disposal as the recycling yard need to be able to demonstrate downstream waste management broadly equivalent to international and Union standards. Regular consumable goods, as provided in table D of appendix 1 in MEPC.269(68), should be listed in part 3 of the inventory if they are delivered with the ship to the ship recycling facility. A general description including the name of item, manufacturer, quantity and location should be entered in part III of the inventory. This includes electrical and electronic equipment and furniture, interior and similar equipment. Possible content of PFOS need to be addressed, whenever replaced or when vessel is due for recycling, to ensure safe and environmentally sound disposal.

# 2018

# Newspaper

## VIETNAMESE

1. **VNEXPRESS: Cẩn trọng với chất PFAS trong đồ gia dụng (11/11/2018)**

https://vtc.vn/hoa-chat-pfas-trong-bao-bi-vai-khong-tham-nuoc-khien-nhieu-tre-bi-benh-than-d438435.html
https://vnexpress.net/suc-khoe/can-trong-voi-chat-pfas-trong-do-gia-dung-3837421.html
https://vtv.vn/y-hoc-the-gioi/chat-pfas-trong-do-gia-dung-co-kha-nang-cao-gay-benh-than-va-ung-thu-20181114110905634.htm
(Republish) https://khoahoc.tv/chat-pfas-trong-hop-dung-thuc-pham-co-the-gay-benh-than-96165
(Republish) https://congnghe.vn/muc/kien-thuc-pho-thong/tin/chat-pfas-trong-hop-dung-thuc-pham-co-the-gay-benh-than-2144752
(Republish) http://giadinh.net.vn/song-khoe/bac-si-canh-bao-bao-bi-thuc-pham-chua-hoa-chat-nay-la-tac-nhan-khien-hang-ngan-tre-bi-benh-than-201811120829177.htm
(Republish) https://webkhoedep.vn/bac-si-canh-bao-bao-bi-thuc-pham-chua-hoa-chat-nay-la-tac-nhan-khien-hang-ngan-tre-bi-benh-than-n-19893.html)
(Republish) https://tintuconline.com.vn/suc-khoe/bac-si-canh-bao-bao-bi-thuc-pham-chua-hoa-chat-nay-la-tac-nhan-khien-hang-ngan-tre-bi-benh-than-n-370561.html
The articles citied the research that was published during Kidney Week in America on November 2018. Researchers found that per- and polyfluoroalkyl substances (PFAS) are harmful to kidney, especially in children. PFAS is present in household products such as waterproof fabrics, non-stick materials such as Teflon, polishes, waxes, paints, cookware, food containers ...

2. **THE AN ORGANIC: Hóa chất PFAS khiến bạn tăng cân sau quá trình ăn kiêng (16/05/2018)**

https://theanorganics.com/blog/khong-phan-nhom/hoa-chat-pfas-khien-ban-tang-can-sau-qua-trinh-an-kieng/

Research was conducted by experts from Harvard University found that exposure to chemicals, such as PFAS or PFC, can cause weight gain again after a diet, especially in women.

3. **MÔI TRƯỜNG VÀ ĐÔ THỊ: Sự ô nhiễm hợp chất PFCs trong nước và trầm tích tại Việt Nam (24/08/2018)**

http://www.moitruongvadothi.vn/khoa-hoc-cong-nghe/nghien-cuu-trao-doi/su-o-nhiem-hop-chat-pfcs-trong-nuoc-va-tram-tich-tai-viet-nam-a31929.html

The article tells about a study of PFC pollution in water and sediment in Vietnam.

4. **TINHTE.VN: Cách mua mỹ phẩm thiên nhiên nào tốt không chứa hóa chất (30/11/2018)**

https://tinhte.vn/threads/cach-mua-my-pham-thien-nhien-nao-tot-khong-chua-hoa-chat.2884915/

The article guides how to buy natural cosmetics that do not contain toxic substances by carefully reading the labels before purchasing them. Do not buy products which contain PFC, PFOA, PFOS or perfluorinated substances.

5. **VNEXPRESS: Hóa chất trong chảo chống dính có thể khiến nam giới vô sinh (7/12/2018)**

https://vnexpress.net/suc-khoe/hoa-chat-trong-chao-chong-dinh-co-the-khien-nam-gioi-vo-sinh-3850730.html

The article tells about the research on PFCs at University of Padua, Italy which was published in the Journal of Clinical Endocrinology & Metabolism. A growing pile of evidence has already quite convincingly established that PFCs may harm the human reproductive system by interfering with hormone signaling, and in the latest – and definitely most tangible – investigation into the chemicals' impact, a team from the University of Padua, Italy, has found that young men who grew up in an area with PFC-contaminated drinking water have significantly smaller penises and less mobile sperm than those who grew up with clean water. Taking the study one step further, first author Andrea Di Nisio and his colleagues used a series of lab-based cellular experiments to provide the first direct evidence that two of the most common PFCs, compounds called PFOA and PFOS, will readily bind to the testosterone receptor and block its activation.

6. **VNEXPRESS (2018) Thói quen cần tránh khi dùng chảo chống dính**

https://vnexpress.net/suc-khoe/thoi-quen-can-tranh-khi-dung-chao-chong-dinh-3829710.html

7. **VOH (2018) Hóa chất từ chảo chống dính nguy hiểm như thế nào?**

http://voh.com.vn/tam-ly-suc-khoe/hoa-chat-tu-chao-chong-dinh-nguy-hiem-nhu-the-nao-279930.html

8. **HÓA HỌC LÀ CHIA SẺ (2018) Hóa học của Teflon và chảo chống dính**

https://hhlcs.com/2018/09/hoa-hoc-cua-teflon-va-chao-chong-dinh.html

9. **TINHTE.VN (2018) Chảo chống dính có gây ung thư hay không?**

(Republish) http://thegioihoinhap.vn/song-khoe/suc-khoe-y-te/chao-chong-dinh-co-doc-hai-nhu-tin-don/

(Republish) http://danviet.vn/gia-dinh/chao-chong-dinh-co-doc-hai-nhu-tin-don-845923.html

(Republish) https://tinhte.vn/threads/chao-chong-dinh-co-gay-ung-thu-hay-khong.2868110/

10. **DÂN VIỆT (2018) 4 dụng cụ nấu nướng cần thay thế ngay để tránh rước họa (Theo Brightside)**

(Republish) http://danviet.vn/am-thuc-4-phuong/thay-the-ngay-4-dung-cu-nau-nuong-nay-neu-khong-muon-ruoc-benh-vao-nguoi-876463.html

(Republish) https://ngoisao.net/an-choi/4-dung-cu-nau-nuong-can-thay-the-ngay-de-tranh-ruoc-hoa-3759908.html
(Republish) https://eva.vn/bep-eva/thay-the-ngay-4-dung-cu-nau-nuong-nay-neu-khong-muon-ruoc-benh-vao-nguoi-c162a352482.html
(Republish) https://doanhnghiepvn.vn/4-dung-cu-nau-nuong-can-thay-the-ngay-de-tranh-ruoc-hoa-d131370.html
(Republish) https://giaoducthoidai.vn/gia-dinh/4-dung-cu-nha-bep-can-thay-the-ngay-de-tranh-ruoc-hoa-3932834-l.html

11. **DÂN SINH (2018) Bạn đã chọn dụng cụ nấu ăn đúng cách để tránh các chất độc đáng sợ?**

http://baodansinh.vn/ban-da-chon-dung-cu-nau-an-dung-cach-de-tranh-cac-chat-doc-dang-so-d72421.html

**DÂN TRÍ (2018) Phụ nữ Việt chuyển hướng sử dụng đồ bếp gia dụng an toàn**

https://dantri.com.vn/doi-song/phu-nu-viet-chuyen-huong-su-dung-do-bep-gia-dung-an-toan-20181204092519961.htm

The articles above show information in order to answering the question, "Is nonstick cookware like Teflon safe to use? How to use and care for nonstick cookware?"

12. **ZING.VN (2018) 11 loại đồ ăn gây ung thư bạn vẫn ăn hàng ngày**

https://news.zing.vn/11-loai-do-an-gay-ung-thu-ban-van-an-hang-ngay-post900339.html

13. **ĐỜI SỐNG VÀ PHÁP LUẬT (2018) Đại tràng 'sợ' nhất những món mà nhiều người Việt thích ăn**

http://www.doisongphapluat.com/tin-tuc/dai-trang-so-nhat-nhung-mon-ma-nhieu-nguoi-viet-thich-an-a256006.html

14. **TIỀN PHONG (2018) Đồ ăn gây ung thư trực tràng cực khủng khiếp, nhiều người Việt thích**

https://www.tienphong.vn/suc-khoe/do-an-gay-ung-thu-truc-trang-cuc-khung-khiep-nhieu-nguoi-viet-thich-1358628.tpo

15. **YAN.VN (2018) Kinh ngạc với những loại thực phẩm quen thuộc ẩn chứa nguyên nhân gây ung thư**

https://www.yan.vn/12-loai-thuc-pham-gay-ung-thu-173363.html

16. **HELLOBACSI (2018) 10 loại thực phẩm gây ung thư mà bạn cần tránh sử dụng**

https://hellobacsi.com/song-khoe/dinh-duong/10-loai-thuc-pham-gay-ung-thu-ma-ban-can-tranh-su-dung/

All article above tell about the cancer risk of microwave popcorn. The possible link between microwave popcorn and cancer isn't from the popcorn itself, but from chemicals called perfluorinated compounds (PFCs) that are in the bags. PFCs resist grease, making them ideal for preventing oil from seeping through popcorn bags. The trouble with PFCs is that some of them can break down into perfluorooctanoic acid (PFOA), a chemical that's suspected to cause cancer.

17. **THE AN ORGANICS (2018) Chất độc quanh ta: PFCs**

https://theanorganics.com/blog/cham-soc-co-the/chat-doc-quanh-ta-pfcs/

The article introduces information about PFCs chemicals

18. **AFIRM GROUP (2018) – Tài liệu thông tin hóa chất CÁC HÓA CHẤT PERFLUORINATE VÀ POLYFLUORINATE**

https://www.afirm-group.com/wp-content/uploads/2018/02/Per-and-Poly-Fluorinated-Chemistries-PFC_vietnamese.pdf

Afirm Group's manual on Perfluorinate and Polyfluorinate chemicals (PFC).

19. **TRUYỀN HÌNH THÔNG TẤN XÃ VIỆT NAM: Phát hiện chất độc hại trong chỉ nha khoa**

http://vnews.gov.vn/phat-hien-chat-doc-hai-trong-chi-nha-khoa

The video reports about a study conducted by the Silent Spring Institute and Public Health Institute in Berkeley, the popular Oral-B Glide floss may be exposing you to elevated levels of toxic chemicals.

Specifically, the authors are concerned about the product containing perfluorooctanesulfonic acids (PFAS). Several studies have linked PFAS to risk of certain cancers, thyroid disease, decreased fertility, immune system issues and high cholesterol. However, a spokesman for Oral-B refuted the study's findings after it was published.

# Policies

### 20. SỞ CÔNG THƯƠNG TỈNH AN GIANG (2018) Thực hiện Công ước Stockholm về các chất ô nhiễm hữu cơ khó phân hủy

http://113.161.212.101:81/CTPro/tin-tuc-khac/thuc-hien-cong-uoc-stockholm-ve-cac-chat-o-nhiem-huu-co-kho-phan-huy-957.html

An Giang Department of Industry and Trade informed about implementation of "Stockholm Convention National Implementation Plans " in the province which was approved by the Provincial People's Committee on April 6, 2018.

# Scientific studies

### 21. SCIENCE OF THE TOTAL ENVIRONMENT (Volume 615, 15 February 2018, Pages 1312-1318)Prenatal dioxin exposure estimated from dioxins in breast milk and sex hormone levels in umbilical cord blood in Vietnamese newborn infants

https://www.sciencedirect.com/science/article/pii/S0048969717325652

Dioxin concentrations remain elevated in the environment and humans residing near the former US Air Force base in Bien Hoa city, South Vietnam. Results from cord blood samples collected from 162 mother-infant pairs suggests dioxins in breast milk reflect prenatal dioxin exposure. Increased levels of TEQ-PCDD/Fs in breast milk were associated with decreased cord blood TS in girls. In boys, a significant reduction of cord blood TS was observed in those exposed to 2,3,7,8-TCDD at high levels (≥ 5.5 pg/g lipid). There was no significant association between E2 and dioxins in breast milk in either sex. These results suggest increased prenatal dioxin exposure is associated with decreased cord TS, but in boys, only high level of 2,3,7,8-TCDD influence cord blood TS.

### 22. SCIENCE OF THE TOTAL ENVIRONMENT (Volumes 616–617, March 2018, Pages 1089-1100) Worldwide drinking water occurrence and levels of newly-identified perfluoroalkyl and polyfluoroalkyl substances

https://www.sciencedirect.com/science/article/pii/S0048969717329285

From 2003 to 2017, multiple studies reported the presence of PFOS and PFOA in tap water from Japan (Harada et al., 2003, Takagi et al., 2008), as well as other PFAAs in drinking water from China (Mak et al., 2009, Zhang et al., 2011), Brazil (Quinete et al., 2009, Schwanz et al., 2016), Norway (Haug et al., 2010), Australia (Thompson et al., 2011), the European Union (Exner and Färber, 2006, Loos et al., 2007, Ericson et al., 2009, Domingo et al., 2012, Gellrich et al., 2013, Schwanz et al., 2016, Le Coadou et al., 2017), South Korea (Kim et al., 2011), Vietnam (Lam et al., 2017), and the USA (Dasu et al., 2017).

To date, the aforementioned surveys have essentially focused on PFCAs (C4/14and C16, C18), PFSAs (C4, C6, C8, C10) and very few precursors (e.g., perfluorooctane sulfonamide (FOSA)). Additionally, the occurrence data of PFAAs in drinking water from Canada, Burkina Faso and Ivory Coast are scarce, if not non-existent (Mak et al., 2009, Munoz et al., 2015b).

In addition, a large breadth of PFASs bear the potential to generate PFAAs through degradation (Liu and Avendaño, 2013). A wide range of newly-identified anionic, zwitterionic, and cationic PFASs were recently reported in aqueous film forming foams (AFFFs) and environmental samples (Place and Field, 2012, D'Agostino and Mabury, 2014, Backe et al., 2013, Barzen-Hanson and Field, 2015, Chu et al., 2016, Mejia-Avendaño et al., 2017b, Munoz et al., 2017a, Xiao, 2017), some of which were shown to generate

fluorotelomer sulfonates and/or PFAAs upon transformation (Moe et al., 2012, Mejia-Avendaño et al., 2016, D'Agostino and Mabury, 2017). Yeung et al. (2017) reported that ultrashort chain (C2–C3) PFAAs could represent over 40% of the total target PFAS in rainwater samples; however, such compounds have been rarely monitored in the previous literature (Mak et al., 2009, Barzen-Hanson and Field, 2015).

Other PFASs recently identified in environmental samples include perfluoroalkane sulfonamides such as perfluorobutane sulfonamide (FBSA, C4) –identified in fish species from multiple Canadian lakes (Chu et al., 2016)– and perfluorohexane sulfonamide (FHxSA, C6) –reported to occur at an AFFF-impacted site (McGuire et al., 2014).

Additionally, previous studies have reported the occurrence of perfluoroethyl cyclohexane sulfonate (PFECHS) in fish, sediment, and surface water (De Silva et al., 2011, Wang et al., 2016). Hitherto, newly-identified PFASs have not yet been investigated in drinking water. Integrated assessment of legacy and newly-identified PFASs is needed to assess the risk associated with PFAS human exposure through drinking water consumption. As such, it appears essential to monitor both short-chain and long-chain legacy PFASs (e.g.: PFAAs), but also fluorotelomer-based compounds and newly-identified PFASs that may be precursors to PFAAs.

In this context, the objective of the present survey was to analyze a large breadth of quantitatively targeted PFASs, including legacy PFAAs, FOSA, fluorotelomer carboxylates and sulfonates, and cationic and zwitterionic PFASs representing various newly-identified PFAS classes, in bottled and tap water samples from Canada and several other countries (Burkina Faso, Chile, China, France, Ivory Coast, Japan, Mexico, Norway, and the USA). Profiles of legacy PFASs in bottled water from different sources, i.e., natural spring water, natural mineral water and treated water from Abidjan (Ivory Coast), Beijing (China), Montreal (Canada), Mexico City (Mexico), and Ouagadougou (Burkina Faso) cities were documented. The occurrence and levels of 29 target PFASs in tap water from 41 cities from 9 different countries were examined. A suspect-target screening was performed in this study to evaluate whether newly identified compounds would occur in drinking water. A preliminary health risk assessment of PFOS and PFOA was also conducted.

**23. ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY (Volume 152, 15 May 2018, Pages 141-150) Distribution, source identification and health risk assessment of PFASs and two PFOS alternatives in groundwater from non-industrial areas**

https://www.ncbi.nlm.nih.gov/pubmed/29402442

This study comprises the concentration profiles and geographical distribution of 14 PFASs collected from water wells in non-industrial areas. The source identification suggested that domestic sewage and atmospheric deposition may contribute significantly to the PFAS occurrence in groundwater in non-industrial areas, while the nearby industrial parks may contribute some, but not at a significant level. Furthermore, the human health risk assessment analysis shows that the health hazards associated with perfluorooctanoic acid (PFOA) and PFOS, two of the main PFAS constituents in groundwater from non-industrial areas, were one or two orders of magnitude higher than those in a previous study. However, they were unlikely to cause long-term harm to the residents via the drinking water exposure pathway alone.

**24. CHEMOSPHERE (Volume 191, January 2018, Pages 450-457): Species-specific profiles and risk assessment of perfluoroalkyl substances in coral reef fishes from the South China Sea**

https://www.researchgate.net/publication/320426021_Species-specific_profiles_and_risk_assessment_of_perfluoroalkyl_substances_in_coral_reef_fishes_from_the_South_China_Sea

The contamination profiles of sixteen perfluoroalkyl substances (PFAS) were examined in coral reef fish samples collected from the South China Sea (SCS), where no information about this topic was previously available in the literature. The results revealed that six PFAS were found in coral reef fish samples from

the SCS. No significant linear relationship was observed between PFOS levels and coral reef fish traits (length, weight) collected in this region. The hazard ratio (HR) values for human consumption of PFOS-contaminated coral reef fishes ranged from 0.04 to 1.48, with *Cephalopholis urodelus* having the highest HR value of 1.18 (higher than 1) among the species, indicating frequent consumption of *Cephalopholis urodelus* might pose potential health risk to local population. The present work has provided the first hand data of PFAS in coral reef fishes in the SCS and indirectly demonstrated the existence of low level PFAS pollution in the SCS.

# Recommendations

## National recommendations

1. The government of Vietnam should provide funding support for further research on PFAS substances and their contamination in the environment and human bodies.

2. The Ministry of Environment and Natural Resources and the Ministry of Industry and Trade should carry out joint PFAS monitoring to identify hotspots near populated and industrial areas. In addition, efforts should also focus on regular monitoring on PFAAs in groundwater to identify possible hotspot areas and find the potential emission sources for preventing expansion of pollution.

3. A complete inventory of PFAS (including PFOA and PFOS) needs to be carried out including in suspected products and process in order to develop a regulatory, institutional framework for sound management of these chemicals.

4. To prevent PFAS pollution and subsequent costly remediation, Vietnam should make an inventory on firefighting foam stocks promptly and replace PFAS-containing foams with fluorine-free foams as early as possible.

5. Regulations and guidelines under the Law on Chemicals should take into accounts of updated scientific findings and recommendations on PFAS.

## Recommendations for Stockholm Convention COP9

1. PFOA should be listed in Annex A with no specific exemptions. If exemptions are granted, they should be for specific products and the listing should require labeling new products that contain PFOA so that Parties can fulfill requirements under Article 6 as done previously for HBCD (SC-6/13).

2. Due to the costly, highly polluting nature of firefighting foams, and the availability of cost-effective, technically feasible non-fluorinated alternatives, no specific exemptions should be adopted either for PFOS or PFOA production and/or use in firefighting foams.

3. Specific exemptions or acceptable purposes for the following 11 uses of PFOS should be ended: photo-imaging, photo-resist and anti-reflective coatings for semiconductors; etching agent for compound semiconductors and ceramic filters; aviation hydraulic fluid; certain medical devices; photo masks in semiconductor and LCD industries; hard metal plating; decorative metal plating; electric and electronic parts for some color printers and color copy machines; insecticides for control of red imported fire ants and termites; and chemically-driven oil production.

4. The following 3 acceptable purposes should be converted into specific exemptions: metal plating (hard metal plating only in closed loop systems); firefighting foams; insect bait for

control of leaf-cutting ants from *Atta* spp. and *Acromyrmex* spp. Sulfluramid should be named in the PFOS listing and its use sharply limited to cultivation of specific crops.

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