ISLANDS Webinar: Used Oil Management in SIDS; 05 July 2023

Short-chain chlorinated paraffins as high volume POP in the Stockholm Convention – risk for waste oils?

Dr. Roland Weber
POPs Environmental Consulting,
73527 Schwäbisch Gmünd, Germany
roland.weber10@web.de
https://www.researchgate.net/profile/Roland-Weber-2
https://scholar.google.com/citations?user=-Cexto4AAAAJ&hl=en

34 POPs listed in the Stockholm Convention (05/2023)

Chemical	Pesticides	Industrial chemicals	Unintentional production	Annex
DDT	+			B
Aldrin, Dieldrin, Endrin, Chlordane, Chlordecone, Toxaphene	+			A
	+			A
Alpha-, Beta-, Gamma-HCH	+		By-product of lindane	A
Endosulfan, Heptachlor, Mirex	+			A
PCP, Dicofol, Methoxychlor	+	+		A
Commercial PentaBDE		+		A
Commercial OctaBDE (Hexa/HeptaBDE)		+		A
Commercial DecaBDE		+		A
Hexabromobiphenyl (HBB)		+		A
Hexabromocyclododecane (HBCD)		+		A
PFOS, its salts and PFOSF	**+**	+		B
PFOA and related compounds				
PFHxS and related compounds		+		A
SCCPs, Dechlorane Plus		+		A
UV-328		+		A
PCB, PeCBz, HCB, PCN, *HCBD*	**+**	**+**	+	A/C
PCDD, PCDF			+	C

PCBs are challenges for waste oil recycling since 1980s with a low POPs content limit of 50 mg/kg. Levels have decreased in recent decades and there is the aim of global PCB management by 2028.

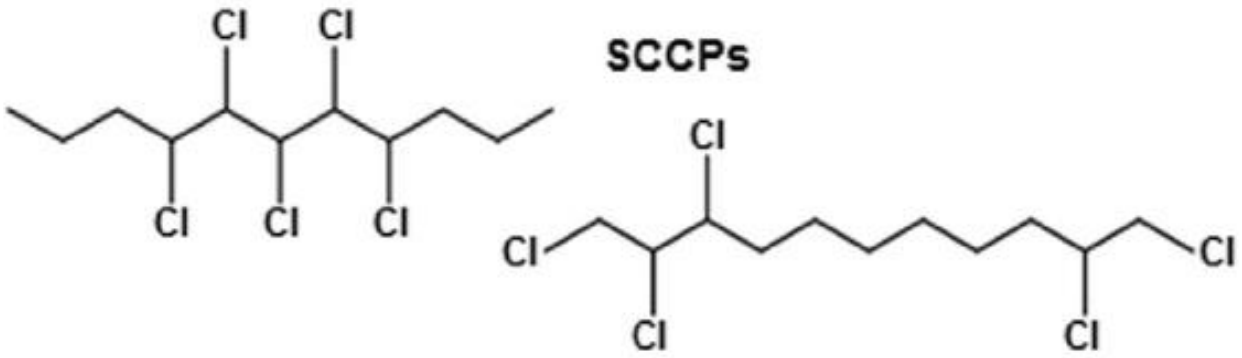
In 2017 the **Stockholm Convention listed short-chain chlorinated paraffins (SCCPs; chlorine >48%) as POPs**.

Also other CP mixtures are POPs, **if they contain more than 1% of SCCPs with >48% chlorine wt**.

Currently 3 more POP candidates are evaluated by the POPs Review Committee including medium-chain chlorinated paraffins (MCCPs); (Chlorpyrífos, **MCCP,** LC-PFAA.)

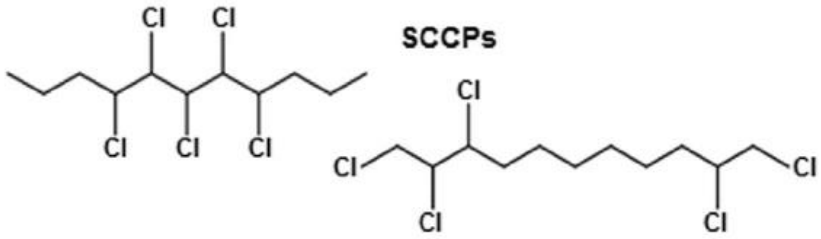
Chlorinated paraffines – chain length & chlorination

- **Chlorinated paraffins (CPs),** are complex mixtures of polychlorinated n-alkanes (molecular formula $C_nH_{2n+2-x}Cl_x$).
- According to their chain length, CPs are subdivided into short-chain CPs (SCCPs, C10–C13), medium-chain CPs (MCCPs, C14–C17) and long-chain CPs (LCCPs, C18–C30),
- Chlorinated paraffins are produced with different chlorination degree varying from 30% to 70% (w/w). The variation option in chain length and chlorination degrees make them versatile and approx. 200 commercial CP formulations are in use.



Listing of SCCPs in the Convention - exemptions for production & use

- The **Convention listing includes exemptions for SCCP production and a wide range of uses:**
  - Secondary plasticizers in flexible PVC, except in toys & children's products.
  - Additives in the production of transmission belts in the natural and synthetic rubber industry;
  - **Lubricant additives, in particular for engines of automobiles, electric generators and wind power facilities, and for drilling in oil and gas exploration, petroleum refinery to produce diesel oil;**
  - Leather industry, in particular fatliquoring in leather;
  - **Metal processing;**
  - Waterproofing and fire-retardant paints;
  - Tubes for outdoor decoration bulbs;
  - Adhesives;



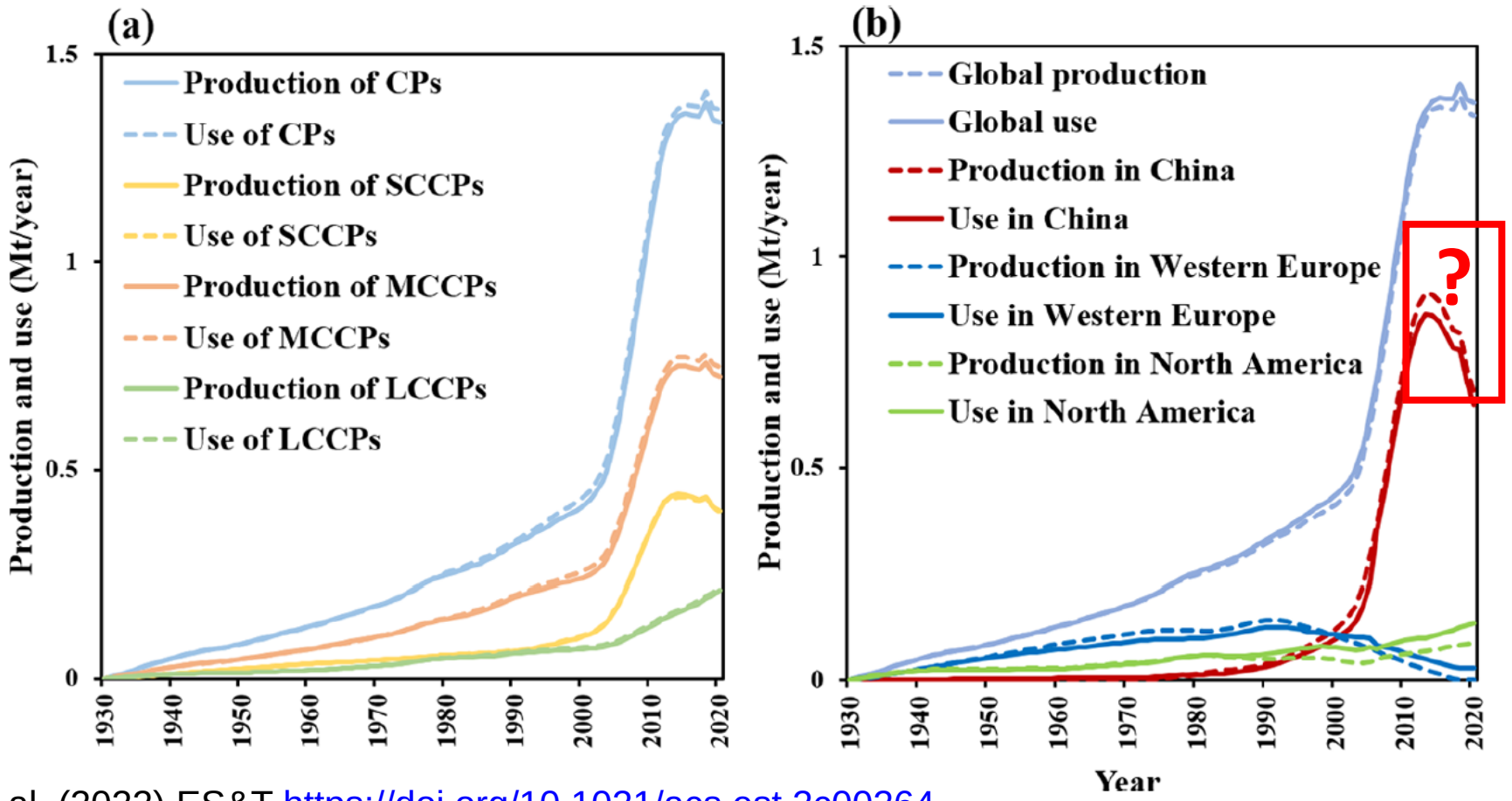
⇒ Therefore SCCPs are further produced, used and released.

⇒ **Hence an assessment of current uses and related contamination of products and waste and recycling streams is needed.**

Decision SC-8/11: Listing of short-chain chlorinated paraffins

Global production of CPs strongly increased

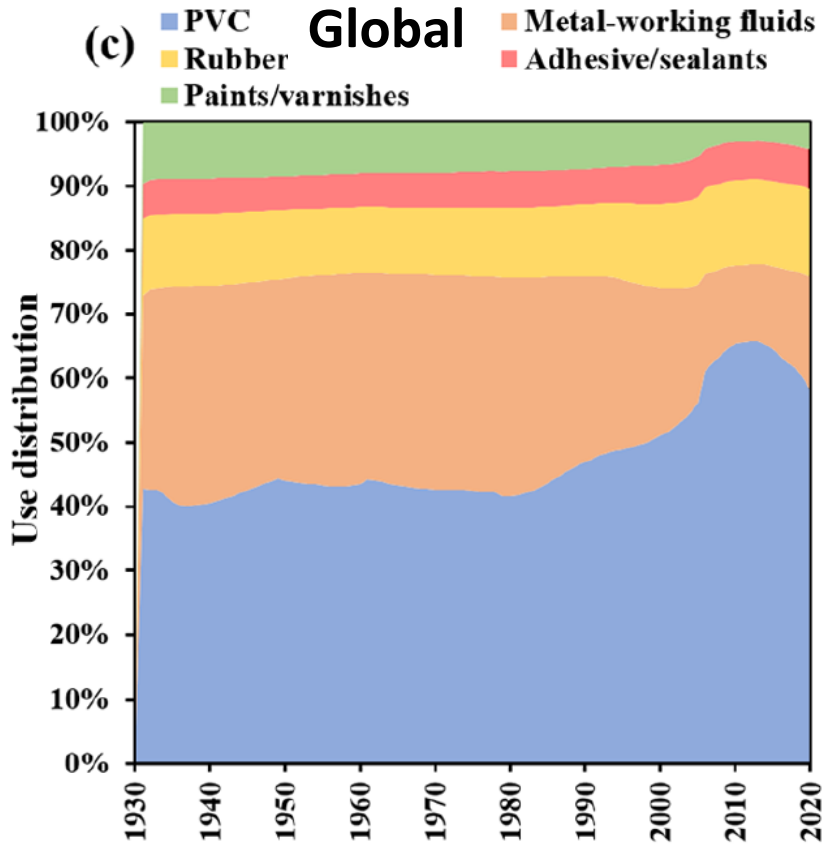
- Global production of CPs increased dramatically over past 20 years and is since ca. 2010 above 1 Mt/a. Current annual production is approx. 1.4 Mt/y (~total PCB!); global production capacity is above 2 Mt/a.
- Total production of SCCPs is estimated to 400,000 t (often in CP-mixtures and therefore higher amount).
- China & India are the largest CP producers with approx. 700,000 t (rather 1 Mt) and 375,000 t (Chen et al. 2022).

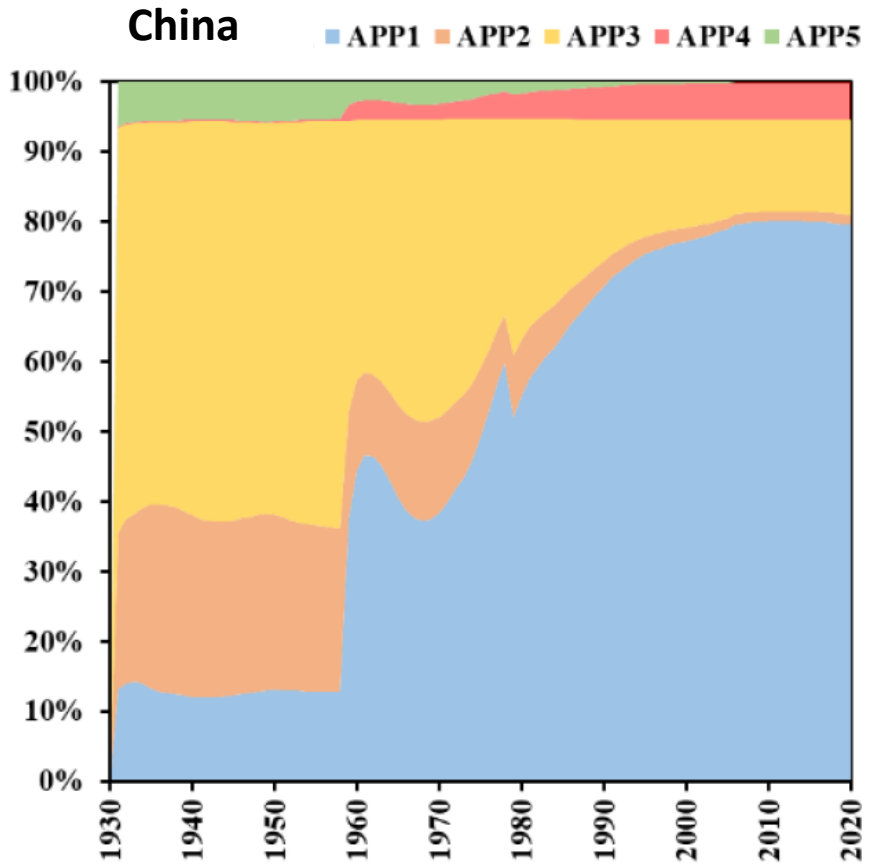


Chen et al. (2022) ES&T https://doi.org/10.1021/acs.est.2c00264

Estimated former and current major uses of chlorinated paraffins

- Major overall use of CPs is as a plasticizer in PVC and in rubber.
- Metal working fluids/lubricants are considered the second largest use
- The Chinese study likely underestimates uses in leather and in paints.



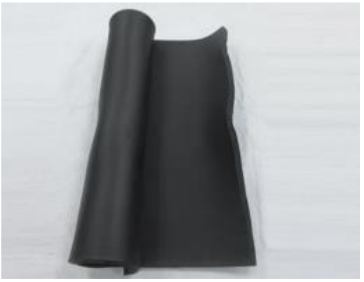


Chen et al. (2022) ES&T https://doi.org/10.1021/acs.est.2c00264

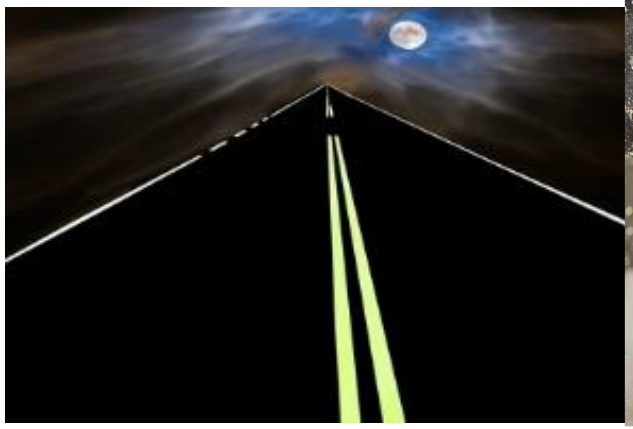
Concentrations of chlorinated paraffins in products

Concentration range of CPs in products (UNEP 2019; Guida et al 2020).

SCCP/CP application	CP content in mg/kg
Lubricant	10,000 to 700,000 (70% weight)
Metal working fluid	10,000 to 700,000 (70% weight)
Adhesive/Sealant	50,000 to 300,000 (30% weight)
Paint/Coating	10,000 to 200,000 (20% weight)
Leather fatliquoring solution	Up to 200,000 (20% weight)
Leather	10,000 to 20,000 (2% weight)
Rubber	10,000 to 170,000 (17% weight)
Textile (in backcoating)	40,000 to 150,000 (15% weight)
PVC (secondary plasticiser)	Up to 100,000 (10% weight)
Ethylene-vinyl acetate (EVA) foam	Up to 70,000 (7% weight)



Chen et al. (2021) ES&T



Pictures (pixelio.de): D. Veith

BRS Secretariat

Pictures ETI, Switzerland

Chlorinated paraffines – use as lubricants

- Car oil with 30-60% CPs on the market.
- **The extent of such car oils and machinery oils is not known and might differ in regions and countries depending on supply chains and vendors of oils.**
- **There might be a risk of contaminating waste oils with SCCPs** (and chlorine).
- **However no data on SCCPs in waste oils!**

TRIPAK® Super Lubricants

SAFETY DATA SHEET

SECTION 1: IDENTIFICATION

Product Name: TRIPAK ANTI-FRICTION METAL CONDITIONER
Manufacturer/Supplier: Tripak Super Lubricants
Address: 10811 99 St. Clairmont, AB T8X 5B4
Phone: 780-567-4908 Fax: 780-567-4277 Office Email: admin@tripaksuperlubricants.com
Emergency Telephone Number: 780-567-4908

SECTION 2: HAZARD IDENTIFCATION

Hazard classification:	Flammable Liquids:	Category 4
	Skin Irritation:	Category 3
	Acute Aquatic Toxicity:	Category 1
	Chronic Aquatic Toxicity:	Category 1

Label elements:
Symbols:

Signal Word: WARNING
Hazard Statements: Causes mild skin irritation.
Very toxic to aquatic life with long lasting effects

Precautionary Statements:
Wear protective gloves/protective clothing/eye protection/face protection.
Wash thoroughly after handling.
Avoid release to the environment.
Do not eat, drink or smoke while using this product.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Names:	% (Vol)	CAS No.
Mineral Spirits	10 - 30	8052-41-3 64742-47-8
Chlorinated paraffin oil	30 – 60	63449-39-8
Petroleum based mineral oil	15 – 40	8012-95-1

Need of assessment if SCCPs and MCCPs are present in relevant concentration in lubricants and waste oils!

- **The Basel Convention has established provisional low POP contents for SCCPs of [100 mg/kg], [1 500 mg/kg] and [10 000 mg/kg] in wastes (UNEP 2023).**

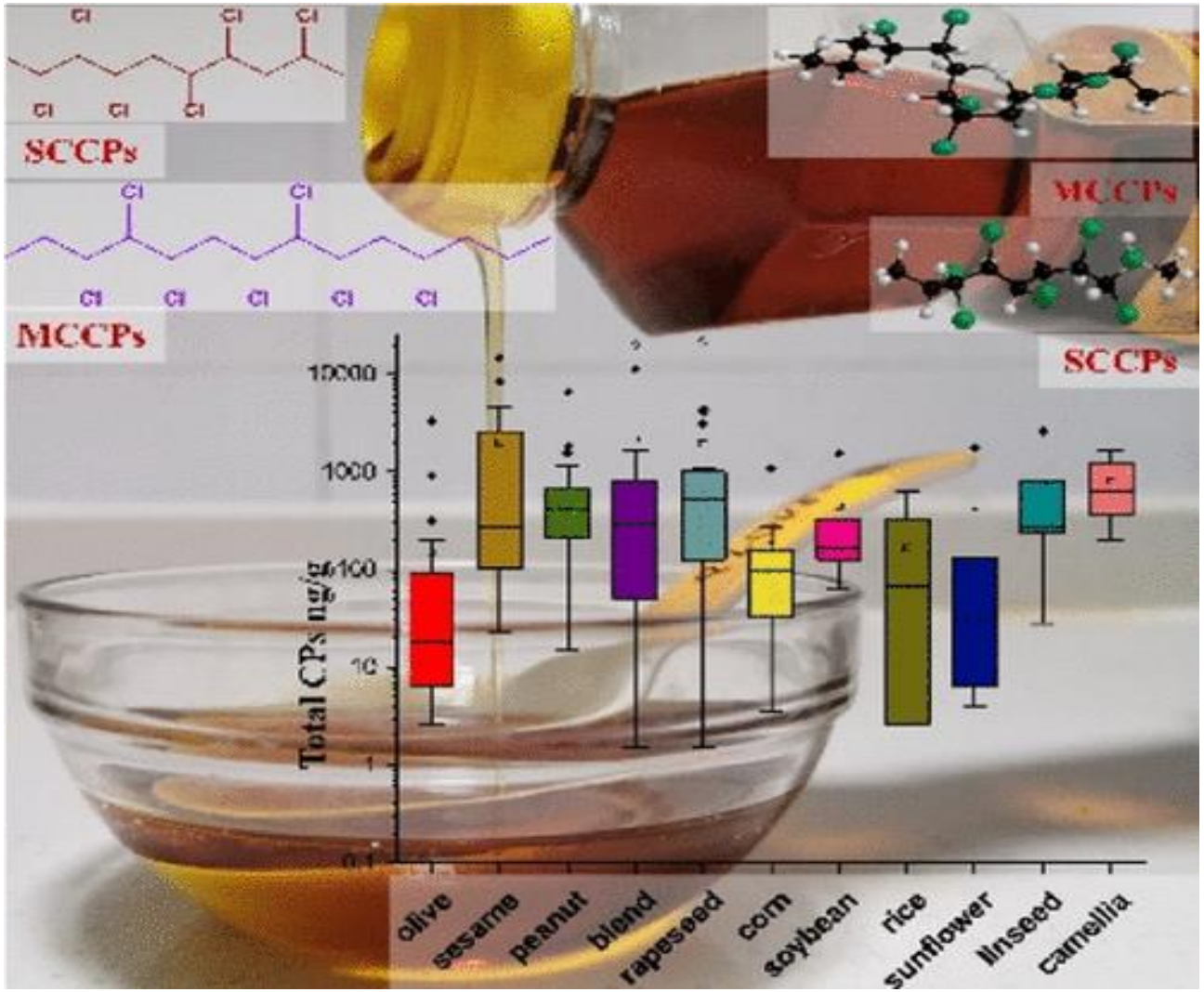
(UNEP (2023) General technical guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants. UNEP/CHW.16/6/Add.1)

- **If the 100 mg/kg would be considered as low POP content, then 1 L car oil containing 50% SCCPs could contaminate 5000 L of waste oil above the low POP content!**
- Also MCCPs are being reviewed by the POP Review Committee and might be listed in 2025 as POP and will likely become soon relevant for waste oil.
- Therefore an **assessment on the presence of SCCPs and MCCPs in car oils and lubricants possibly entering waste oil streams is needed**.
- **As a first step some waste oils might be screened for total halogen (AOX). Waste oils above 50 mg/kg total organic chlorine should be screened for the presence of SCCPs, MCCPs and PCBs to understand if there is a risk for POPs in waste oils and recycling.**

Food for thought: SCCPs and MCCPs in cooking oils

- SCCPs and MCCPs were analysed in 176 cooking oils and 19 oil containers from various markets in China in 2020.
- The concentrations of SCCPs and MCCPs in the **cooking oils were up to 16 mg/kg and 11.6 mg/kg**, respectively.

Gao et al. (2020) J. Agric. Food Chem. 68, 29, 7601–7608 https://doi.org/10.1021/acs.jafc.0c02328



Thank you for your attention !

More Information

Review SCCP technosphere Guida et al (2020): https://doi.org/10.1016/j.emcon.2020.03.003

Review CP production & use Chen et al. (2022): https://doi.org/10.1021/acs.est.2c00264

Basel Convention: www.basel.int

Stockholm Convention: http://chm.pops.int/

Rotterdam Convention: www.pic.int

SAICM: http://www.saicm.org/

IOMC/OECD: https://iomctoolbox.org/; http://www.oecd.org/chemicalsafety/

Science: www.ipcp.ch; www.foodpackagingforum.org/; www.isde.org/; https://ikhapp.org/scientistscoalition/

Industry: https://endplasticwaste.org/; https://plasticseurope.org/; http://www.suschem.org/

NGO: www.ipen.org; www.ciel.org/; www.ban.org; www.chemsec.org; www.wecf.org; https://chemtrust.org/

Better-world-links: http://www.betterworldlinks.org/