Tilsetningsstoffer i plast

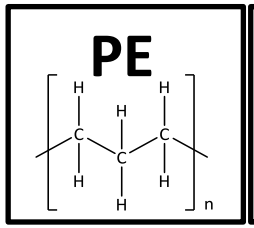
DORTE HERZKE

dhe@nilu.no

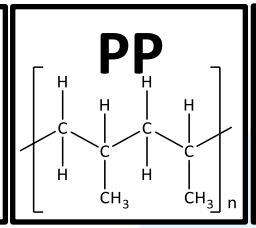
Hovedtyper av plastpolymere

SOURCE: PlasticsEurope Market Research Group (PEMRG) and Conversio Market & Strategy GmbH

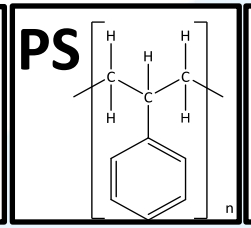
C-C backbone



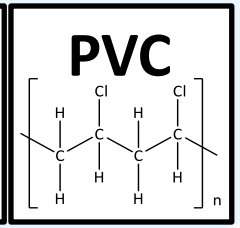
Poly-ethylene



Poly-propylene

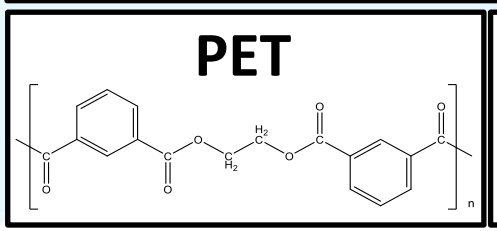


Poly-styrene

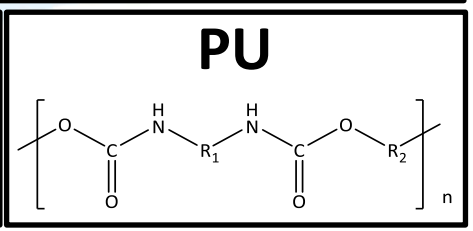


Poly(vinyl-chloride)

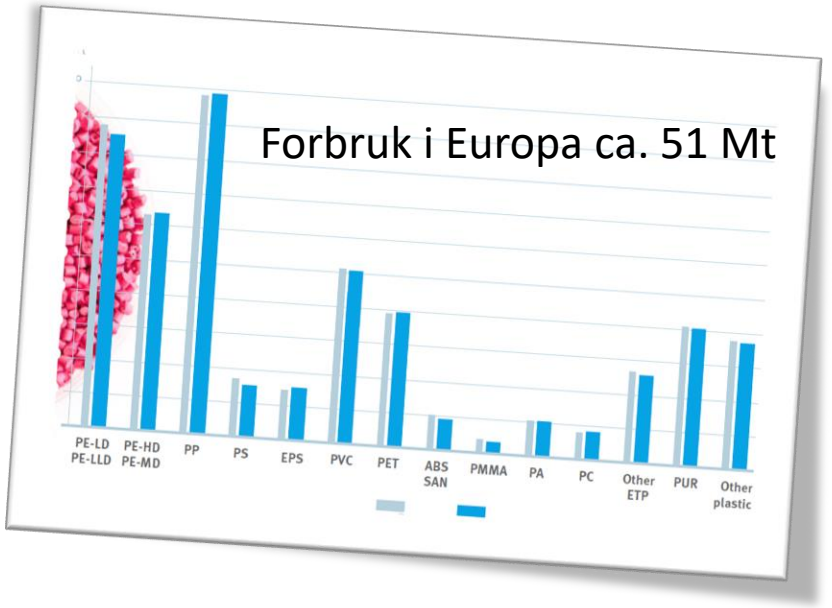
Heteroatoms in backbone



Poly(ethylene terephthalate)



Polyurethane



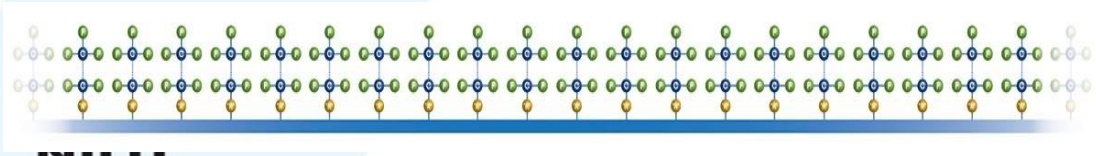
…plast er ikke bare en karbon-hydrogen kjede

Fargepigmenter, stabilisatorer, mykgjører, flammehemmere,

og mange flere

Kompleks blanding av kjemikalier

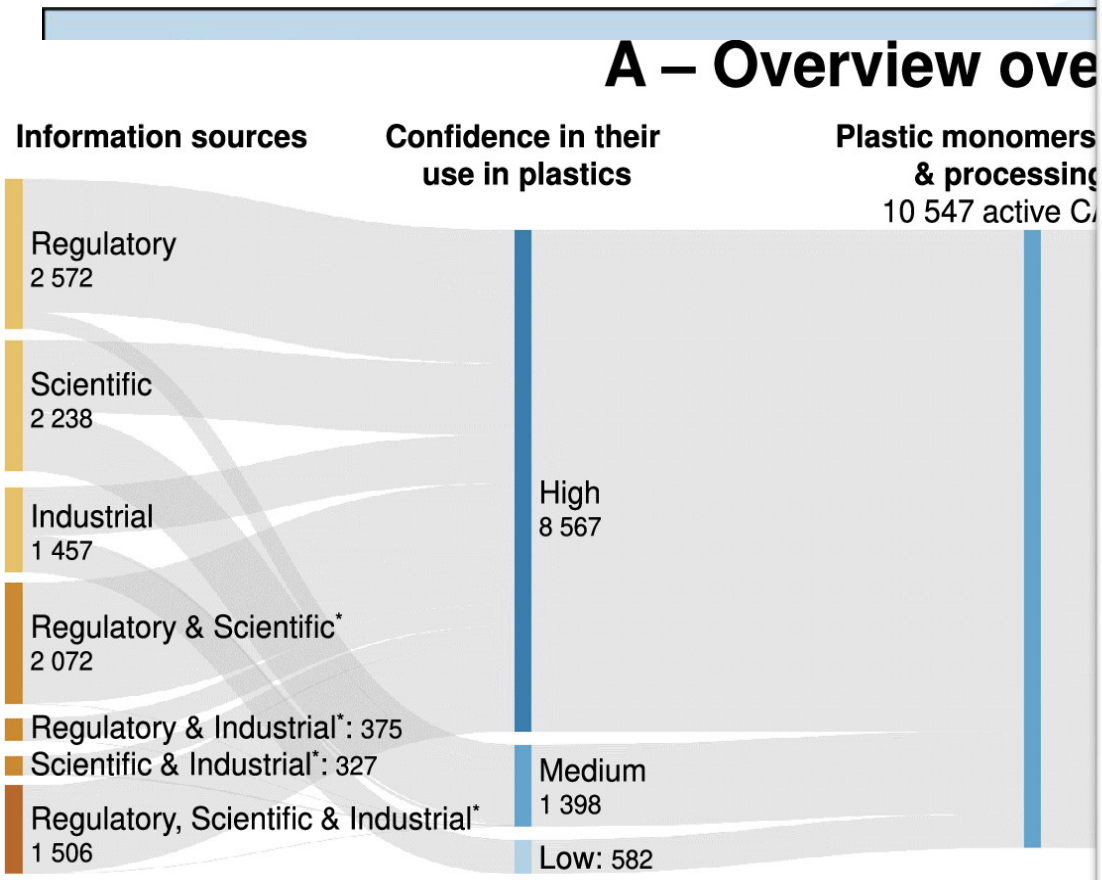
Reaktiver



&

Addit

Er det så mange?



* Substances are found in sources of all mentioned types
** These active CASRNs are associated with 24 901 deleted CASRNs and 22 alt
*** Substances of unknown or variable composition, complex reaction products, o

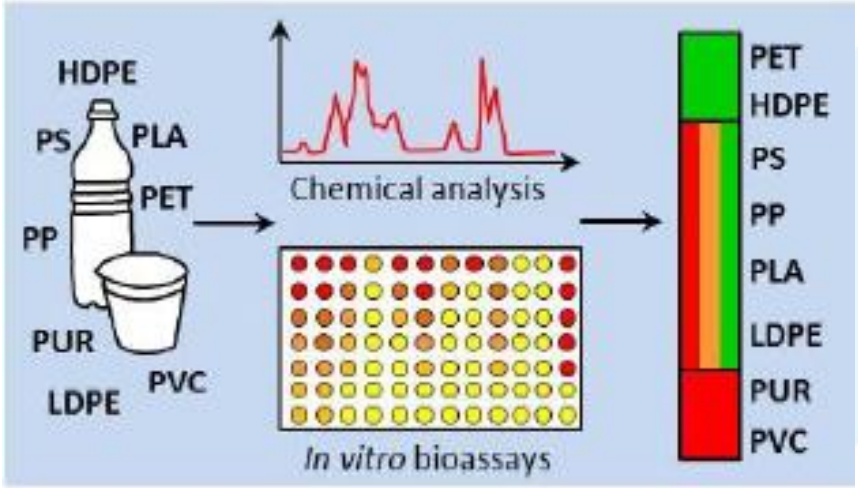
Table 2 Types of additives in plastic materials

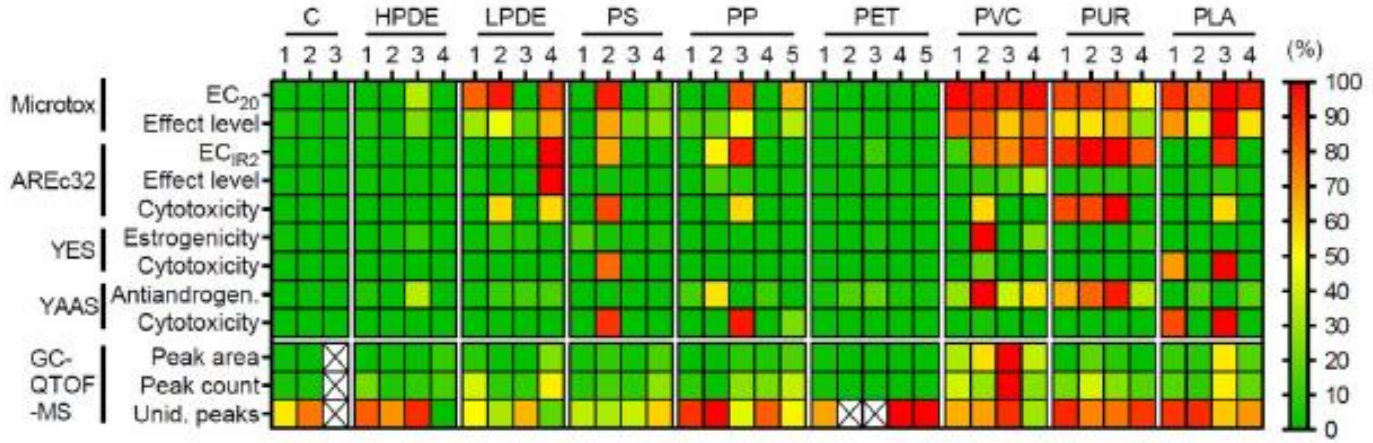
Category/type of additive	Substances	Polymers in which applied	Typical range % w/w
Plasticisers	Chlorinated paraffins, diisoheptylphthalate (DIHP), diisodecylphthalate (DIDP), 1,2-benzenedicarboxylic acid, di-C_{7-11}-branched and linear alkyl esters (DHNUP), benzyl butyl phthalate (BBP), bis(2-ethylhexyl)phthalate (DEHP), bis(2-methoxyethyl) phthalate (DMEP), dibutyl phthalate (DBP), dipentyl phthalate (DPP), di-(2-ethylhexyl) adipate (DEHA), di-octyladipate (DOA), diethyl phthalate (DEP), diisobutylphthalate (DiBP), tris(2 chloroethyl)phosphate (TCEP), dicyclohexyl phthalate (DCHP), diheptyl adipate (DHA), heptyl adipate (HAD), and heptyl octyl adipate (HOA)	PVC, cellulose plastic	10–70
Flame retardants	Chlorinated paraffins, brominated flame retardants with antimony (Sb) as synergist (e.g. polybrominated diphenyl ethers (PBDEs), decabromodiphenylethane, tetrabromo-bisphenol A (TBBPA), tetrabromophthalic anhydride (TBPA), phosphorous flame retardants (TCEP or tris(2-chloriscopropyl)phosphate (TCPP)), hexabromocyclododecane (HBCDD)	Various	2–60
Blowing agents	Azodicarbonamide (ADC), p-toluenesulfonylhydrazide (TSH), 4,4'-oxibis (benzenesulfonylhydrazide) (OBSH), p-toluenesulfonyl semicarbazide (TSSC), 5-phenyltetrazole (5-PT), N,N'-dinitroso-pentamethylenetetramine (DNPT)	Various	0.05–20
Colourants	1,4-Diamino-2-methoxy-9,10-anthracenedione, 2-methyl-4-((2-methylphenyl)azo)-benzenamine	Various	0.25–5
Antifogging additives	Glycerol esters, polyglycerolester, sorbitan esters and their ethoxylates, nonylphenol ethoxylates, alcohol ethoxylates	PE, PP, EVA copolymers, PVC	1–3
Heat stabilisers	Nonylphenol (barium and calcium salts)	PVC	0.5–3
Anti-static additives	Fatty acid esters, ethoxylated alkylamines, diethanolamides, ethoxylated alcohol, alkylsulfonates, alkylphosphates, tetraalkylammonium salt, trialkylbenzylammonium salt	PE, PP, PVC, PS/HIPS, ABS/SAN	0.1–3
Lubricants	Fatty acid esters, hydrocarbon waxes, metal stearates, amide waxes, ester waxes	PVC, PS/ABS, PP, PE, engineered thermoplastics	0.1–3
Curing agents	4,4'-Diaminodiphenylmethane (MDA); 2,2'-dichloro-4,4'-methylenedianiline (MOCA), formaldehyde – reaction products with aniline; hydrazine, TGIC/β-TGIC		0.1–2
Primary Antioxidants	Irganox E 201, butylated hydroxytoluene (BHT), Irganox 1076, Irganox 1135, Irganox 2246, Irganox 259, Irganox 1098, Irganox 1222, Irganox 1425, Irganox 245	PP, PE, styrenics, engineered resins, PVC	0.01–1
Antimicrobials	2-*n*-octyl-4-isothiazolin-3-one in dioctylphthalate, Ag-Zn-zeolites, 2,3,5,6 tetrachloro-4 (methylsulfonyl) pyridine, N-(trichloro-methylthio) phthalamide, 10,10'-oxybisphenoxarsine (OBPA), triclosan	Plasticised PVC, PU, LDPE, polyester	0.001–1
Secondary Antioxidants	Irgafos TNPP, Irgafos 168, Irgafos 126, ADK Stab PEP 36, ADK Stab HP-10, Hostanox P-EPQ, Ethanox 398, Weston 618, Irgafos 12, Irgafos 38, Ultranox 641, Irganox PS 802, Irganox PS 800	PP, PE, styrenics, engineered resins, PVC	0.02–0.5
Nickel Quenchers	Cyasorb UV-1084, Irgastab 2002, UV Chek AM 101, Sanduvor NPU	PP	0.05–0.4
UV Absorbers	UV-P, UV-320, UV-326, UV-327, UV-328, UV-329, UV-350, UV-360, UV-571, Tinuvin 213, Tinuvin 234, Tinuvin 840, ADK Stab LA 51, Seesorb 1000, Cyasorb UV-9, Uvinul 400, Cyasorb UV-24, Cyasorb UV-531	Various	0.1–1
Hindered Amine Stabilisers	Tinuvin 770, Tinuvin 622 LD, Chimassorb 944, Chimassorb 119, Tinuvin 765, Tinuvin 144, Tinuvin 123, Chimassorb 2020		0.1–1.5
Slip additives	Erucamide, oleamide, stearamide	LDPE, PP	0.05–0.15
Polymer processing aids	Fluoropolymers (e.g. copolymer of vinylidene fluoride and hexafluoropropylene), polydimethyl siloxane oils	LLDPE	<0.1
Polymeric impact modifiers	Methacrylate butadiene styrene compounds, chlorinated PE, acrylic polymers, ethylene vinyl acetate	PVC, PE, PP	

Helene Wiesinger, Zhanyun Wang, and Stefanie Hellweg
Environmental Science & Technology **2021** *55* (13), 9339-9351
DOI: 10.1021/acs.est.1c00976

REVIEW
Oceanic long-range transport of organic additives present in plastic products: an overview
Helena Andrade[1], Juliane Glüge[1], Dorte Herzke[2], Narain Maharaj Ashta[1], Shwetha Manohar Navaqar[1] and Martin Scheringer[1,2]

Er det farlig?





NILU

Environmental Science & Technology

Ecotoxicology and Human Environmental Health

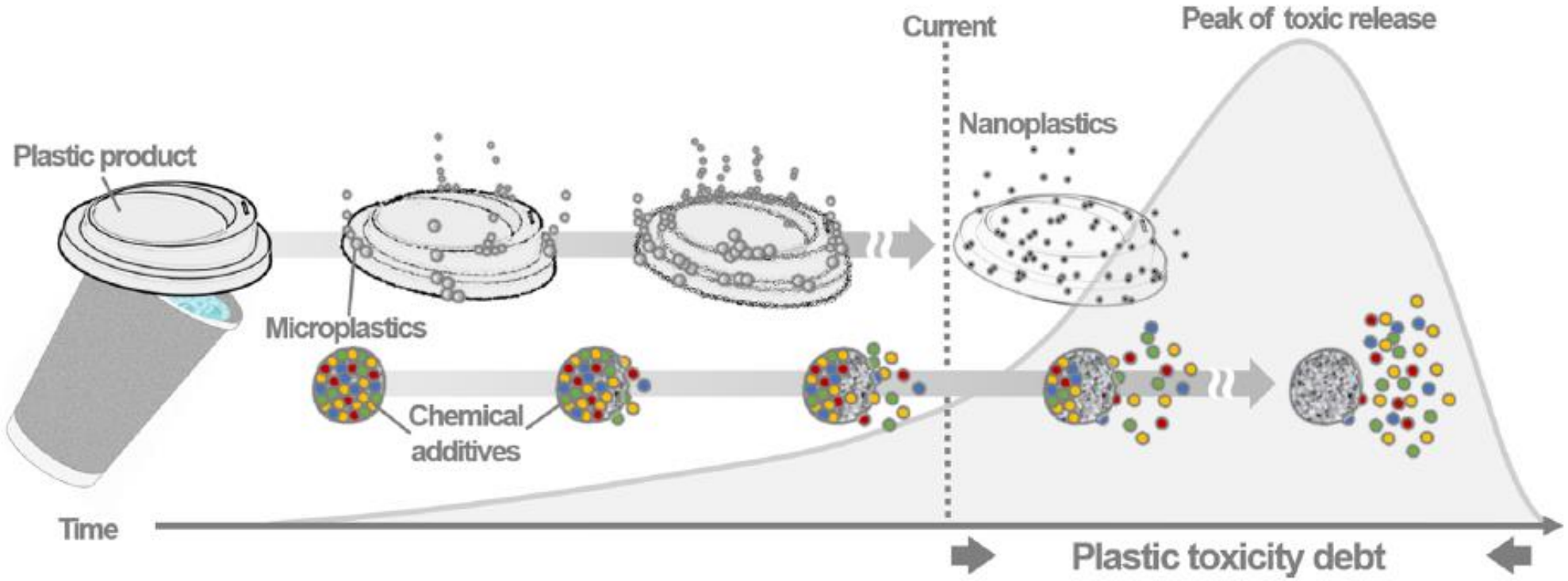
Benchmarking the *in vitro* toxicity and chemical composition of plastic consumer products

Lisa Zimmermann, Georg Dierkes, Thomas A. Ternes, Carolin Völker, and Martin Wagner

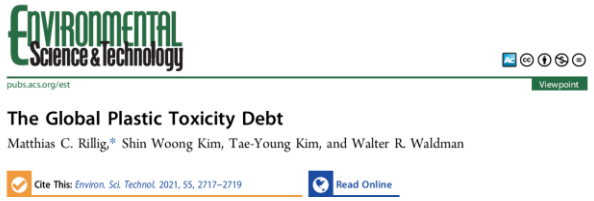
Environ. Sci. Technol., Just Accepted Manuscript • DOI: 10.1021/acs.est.9b02230 • Publication Date (Web): 05 Aug 2019

Downloaded from pubs.acs.org on August 6, 2019

Additiver slippes ut over hele nedbrytningsperioden av en plast gjenstand



… så selv om additivet brytes raskt ned i miljøet, kan den lekke ut av plast over veldig lang tid


Environmental Science & Technology
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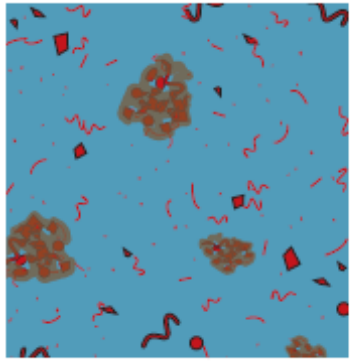
Viewpoint
The Global Plastic Toxicity Debt
Matthias C. Rillig,* Shin Woong Kim, Tae-Young Kim, and Walter R. Waldman
Cite This: Environ. Sci. Technol. 2021, 55, 2717−2719
Read Online

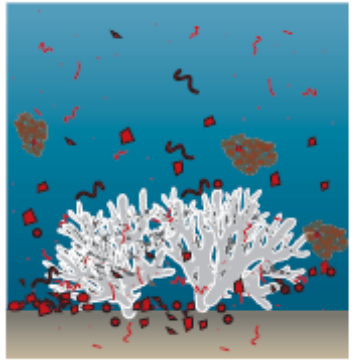
Plastsøppel sprer seg i hele miljøet

A Remote ocean surface and coastlines
Ocean gyres are reservoirs for plastic debris and currents can transport plastic to remote and ecologically sensitive coastlines.

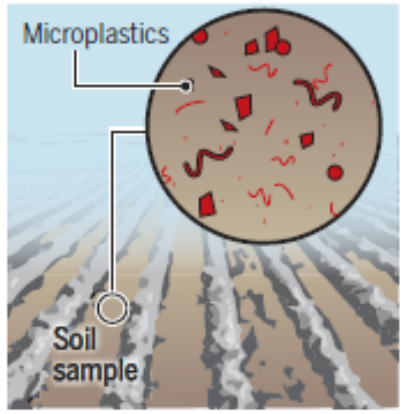
B The water column
Neutrally buoyant plastic and plastic aggregates with organic matter accumulate in the water column of the ocean and lakes and can be taken up by organisms.



C The deep sea
Sinking plastic accumulates on the seafloor in conditions ideal for long-term preservation in benthic ecosystems and the sedimentary crust.



D Soils
Plastic applied to cropland as mulch and with contaminated compost accumulates and may be slowly released as weathered microplastic.



E The body
Ingested or inhaled particles can accumulate in body cavities, release fragments and chemicals, and potentially penetrate epithelial layers and tissues.

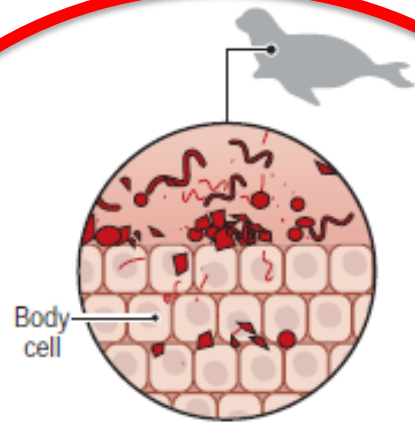
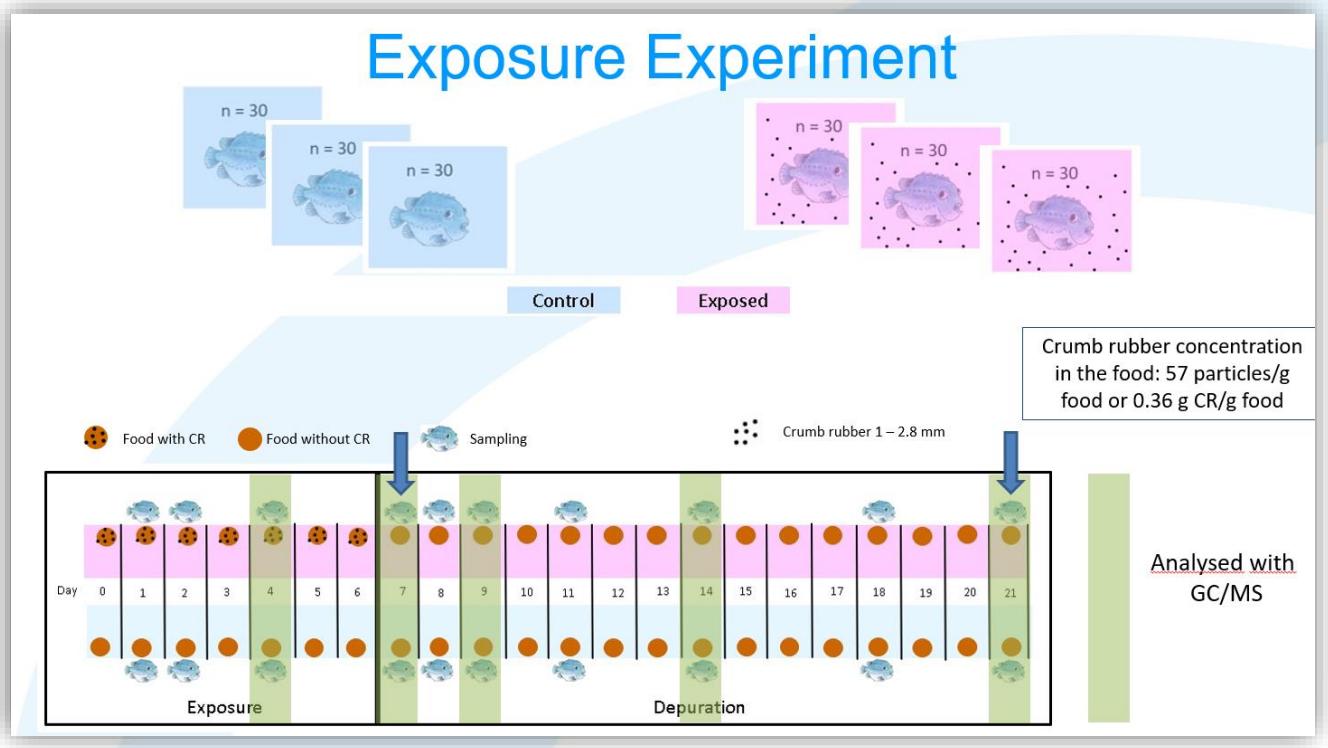


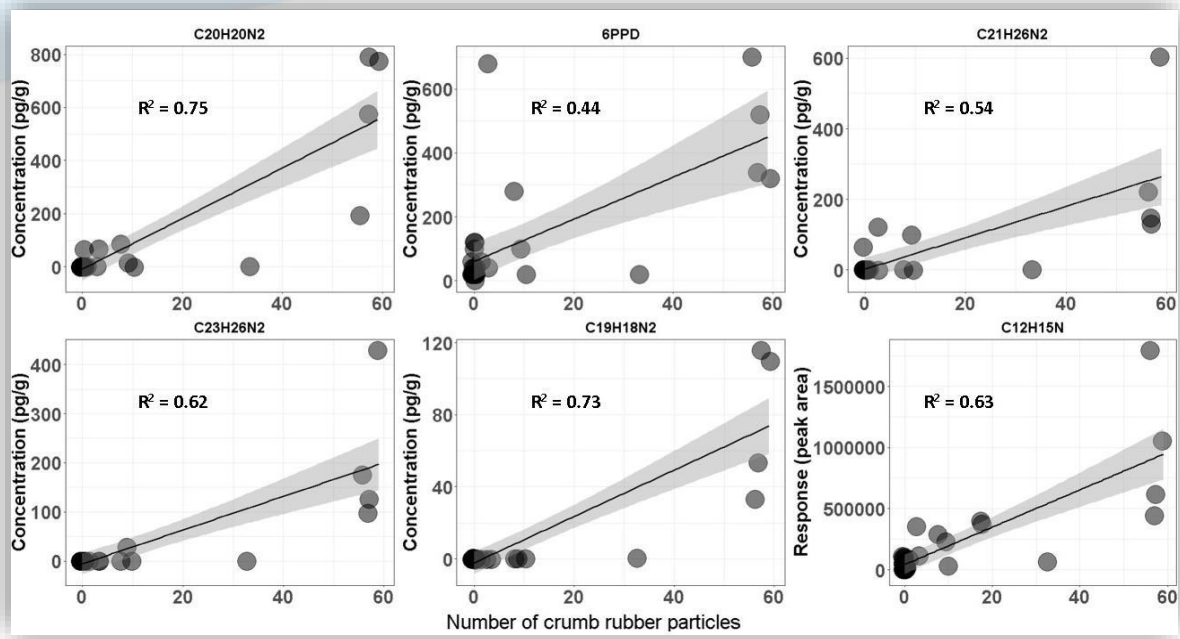
Fig. 1. Locations where poorly reversible plastic pollution accumulates

Chapter 6
Weight of Evidence for the Microplastic Vector Effect in the Context of Chemical Risk Assessment

Albert A. Koelmans, Noël J. Diepens, and Nur Hazimah Mohamed Nor

Plast i rognkjeks





Ingestion of Crumb Rubber and Uptake of Associated Contaminants in the Marine Lumpfish (*Cyclopterus lumpus*)

Fanny Hägg[1,2], Dorte Herzke[2,*], Vladimir Nikiforov[2], Mari Creese[3], Andy M. Booth [4], Lisbet Sørensen [4], Sophie Bourgeon[5] and Claudia Halsband[2]

[1]UiT - The Arctic University of Norway; [2]Akvapla-niva, Norway; [3] NILU- Norwegian Institute for Air Research, Norway; [4]SINTEF Ocean, Norway

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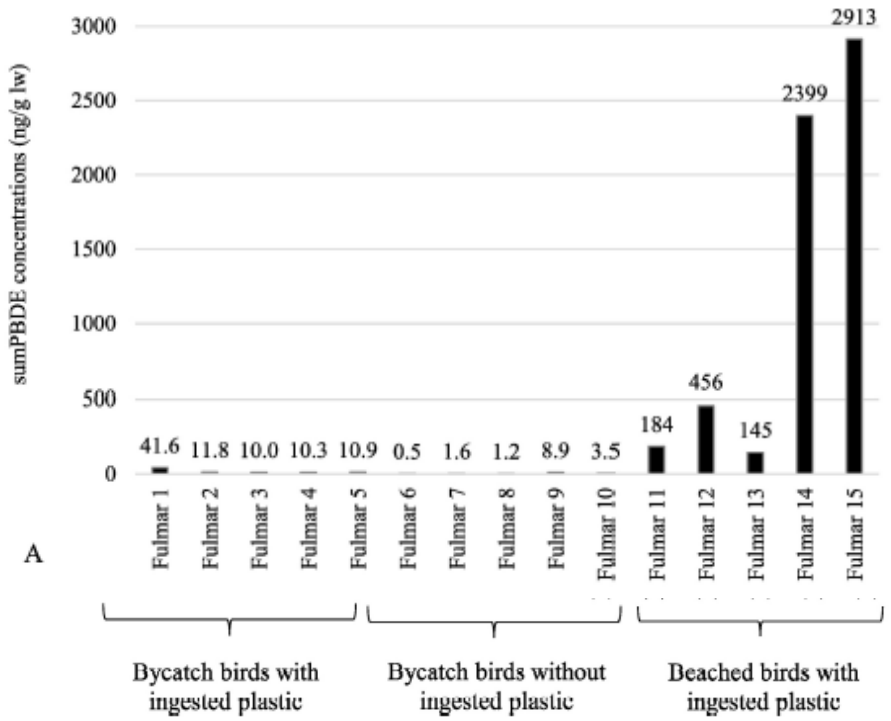
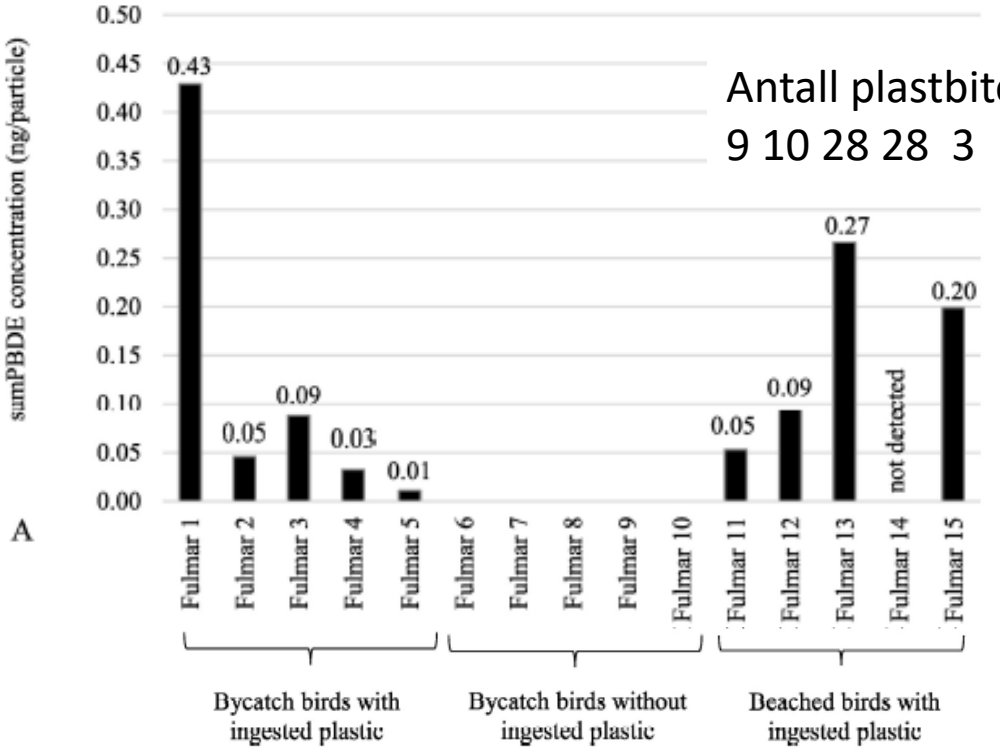
Plast i havhest

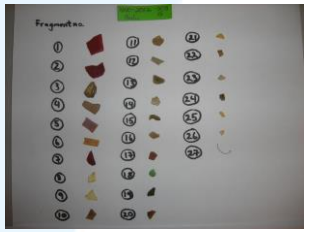
Liver



Ingested plastic



Antall plastbiter:
9 10 28 28 3



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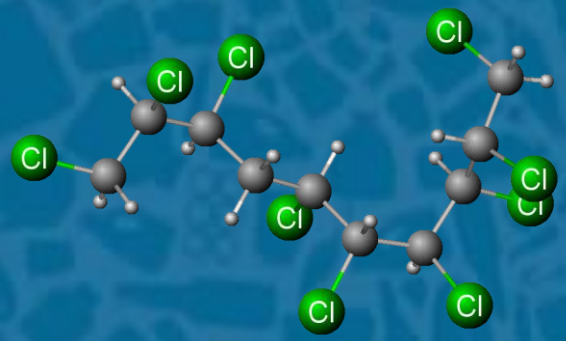
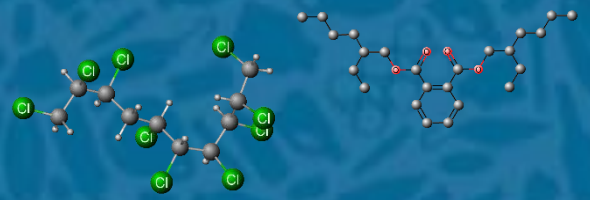
Science of The Total Environment

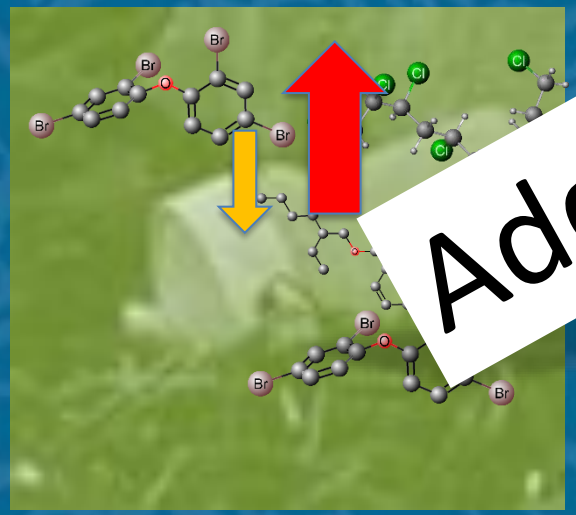
Ingested plastics in northern fulmars (*Fulmarus glacialis*): A pathway for polybrominated diphenyl ether (PBDE) exposure?

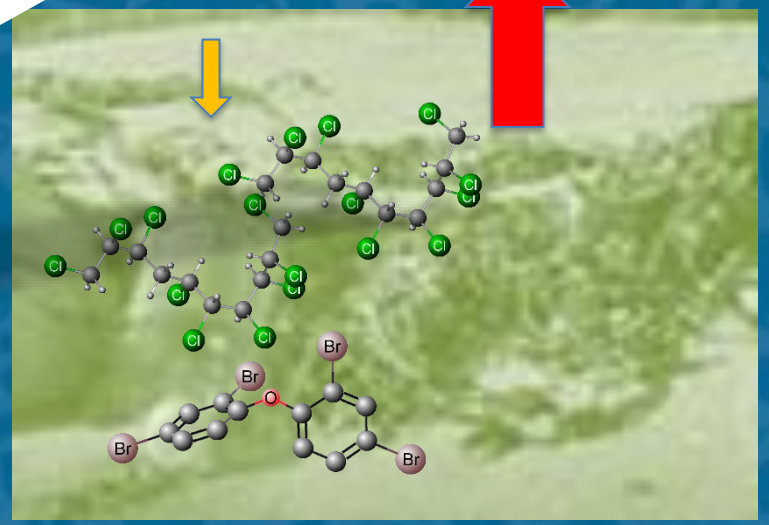

© Bo Eid

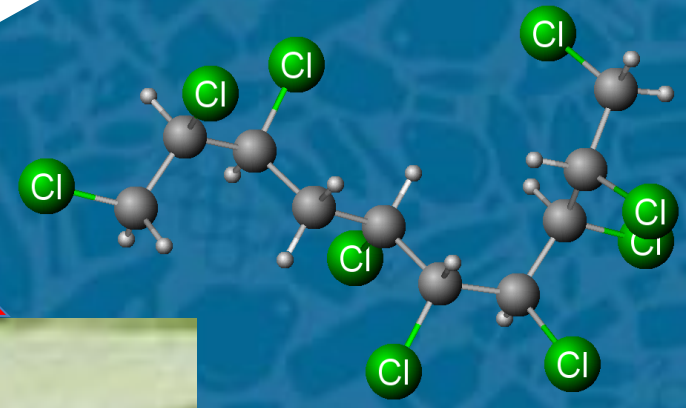
… det er mange forskjellige kjemiske stoffer som kan finnes i og på plast











Additiver blir til miljøgifter

… Men det er ikke hele sannheten


… mennesker har forurenset miljøet med
miljøgifter i mer enn 100 år allerede …
© Bo Eide

… hver plast bit i miljøet er en til kilde til forurensing…

Etter mer enn 10 år med forskining på plastforurensing vet vi:

- **At hvor det er plast da er det additiver**
- **At additiver kan lekke ut av plast**
- **At mange dyrearter spiser plast**
- **Additiver kan også lekke ut av plast i dyr som har spist plasten**
- **Skjebnen i miljøet avhenger av type additiv**
- **Effekten på dyr og mennesker er enda veldig uklart**
- **Vi må gjøre noe**

… så vet vi nok?

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Vi vet ikke ...

- Hva er de mest brukte additiver
- Hvilke additiver lekker mest ut i naturen
- Er dyret som spiser mest plast (f.eks. havhest eller en hval), også dyret som tar opp mest additiver
- Hvor mye har størrelse og type plast/overflaten å si
- Hvilke additiver er mest skadelig for menneskene og dyr

- Hva er de riktige tiltakene for å redusere utslipp

Ta-med-hjem beskjeder

→ Der vi finner plast, finner vi også additiver

→ Jo mer plasten sprer seg i miljøet, jo mer vil også additivene spre seg

→ Plast kan frakte mange forskjellige additiver til alle deler av økosystemet og til oss mennesker

→ Plasten og additivene vil forbli i naturen over lang tid

→ Det er bedre å forhindre utslipp enn å rense opp

NILU

Takk for oppmerksomheten!

Painting: Scott Thoe

NILU

Framsenteret