Monitoring of bisphenol A and its analogues in environmental samples from Norway

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Bisphenols

- Bisphenol A (BPA) - a high-production volume chemical -a monomer in the production of polycarbonate polymers.
- EFSA lowered the TDI from 50 to 4 µg/kg of the body weight
- Endocrine disruptor- Health Canada and the European Union have banned BPA use in baby bottles and in coating of infant formula (US FDA).
- BPA replaced with bisphenol S (BPS) in thermal paper
- Bisphenol F (BPF) and bisphenol B (BPB) are possible replacements in the production of epoxy resin and polycarbonate. Already detected in canned foods and soft drinks.
- Bisphenol AF (BPAF) used in manufacturing of phenolic resins or fluoroelastomers. Annual production is assumed to be in the range of 5 to 300 t in the USA (Yang et al., 2014).

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Samples

- Marine environment: water, sediment, polychaete, shrimps, herring gull (eggs and blood)
- Terrestrial: soil, earthworms, birds (eggs): fieldfare, sparrowhawk, tawny owl

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Extraction and cleanup

- Water samples

Sequential cleanup with Oasis HLB SPE and AFFINISEP Bisphenols

- Biological samples

Quechers extraction, further sequential cleanup with 2 SPE columns

- Sediment/soil samples

ASE with acetone:hexane and further cleanup with 2 SPE columns

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Analysis

- Agilent 1290 Infinity UHPLC coupled with Agilent 6550 QTOFMS, Dual Jest Stream ESI-
- Mobile phase: methanol water, target compounds separated on Waters HSS T3 (2.1 x 150 mm)
- Mass Hunter software used to acquire and process the data
- 19 different bisphenols

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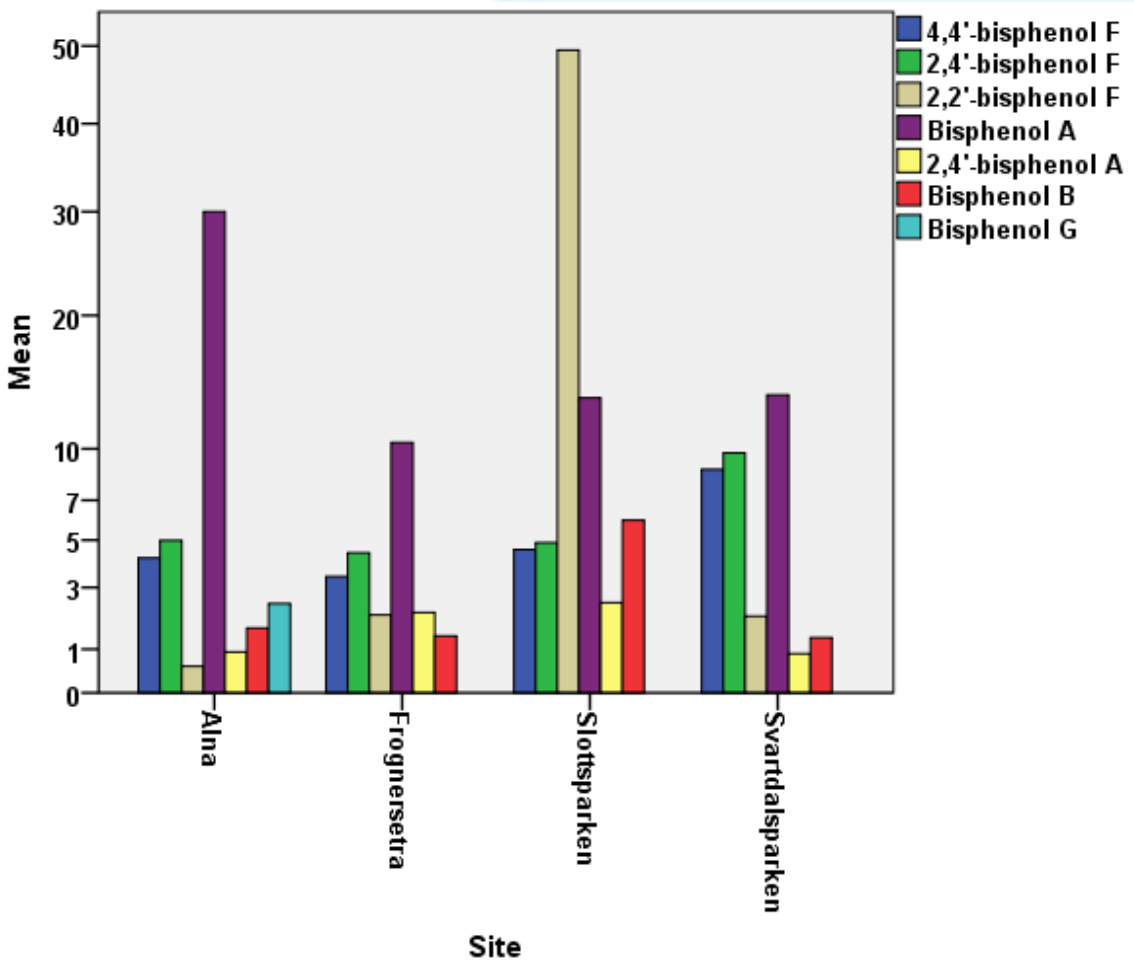
Bisphenols in soil (ng/g)



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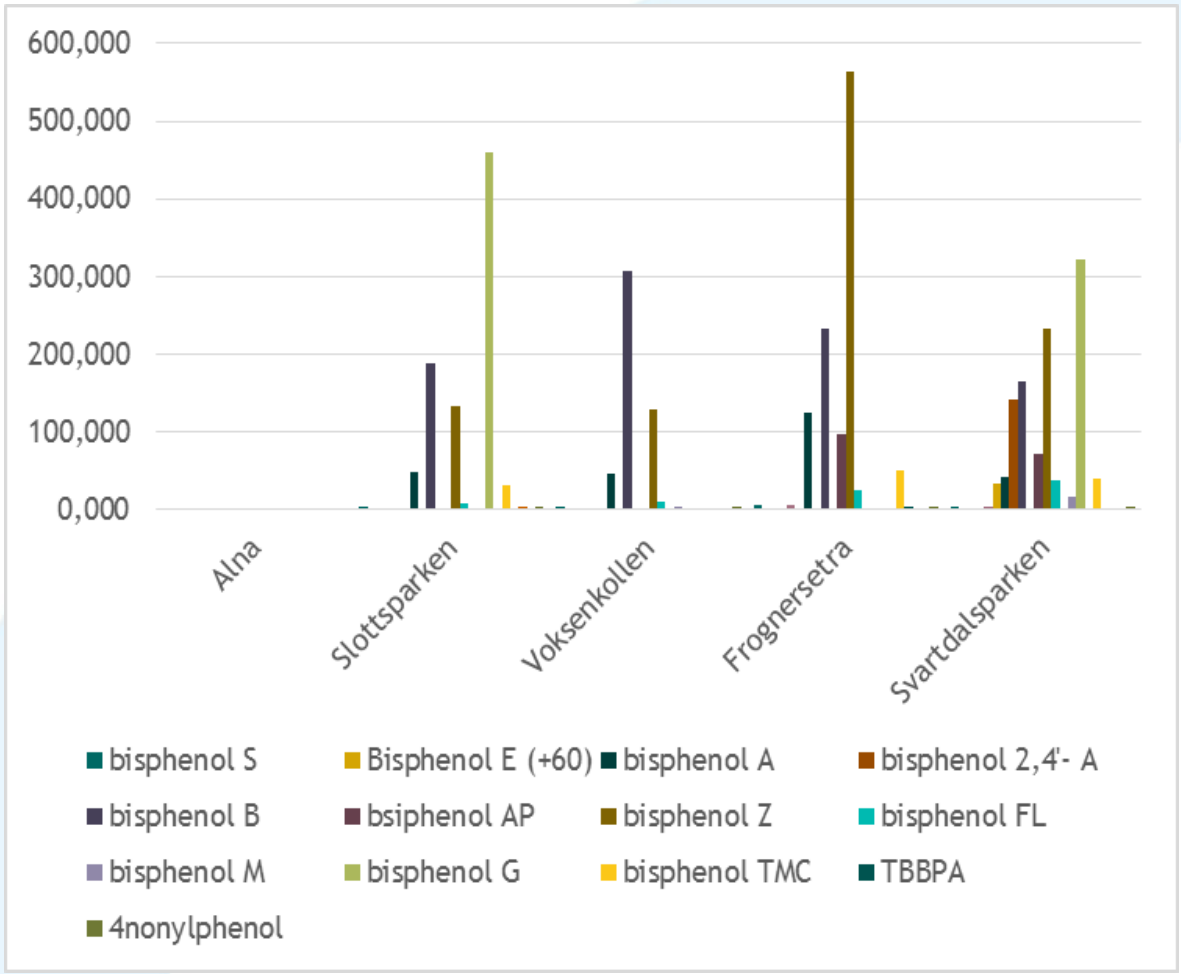
Bisphenols in earthworms (ng/g)



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Bisphenols in birds

- 2,4-bisphenol F detection frequency of 60% (<LOD – 2.92 ng/g).
- Bisphenol A only found in 1 egg (299 ng/g ww.)
- SumPhenols: <LOD to 300 ng/g ww
- (median of 1.8 ng/g ww).

Fieldfare
Photo: Wikipedia

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Bisphenols in birds

Sparrowhawk
Photo: Wikipedia

- Detected only Bisphenol S and TBBP A .
- SumPhenol <LOD to 2.7 ng/g ww

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Bisphenols in birds

Isomers of bisphenol F found occasionally (<LOD to 4.4 ng/g ww

Tawny owl
Photo: Wikipedia

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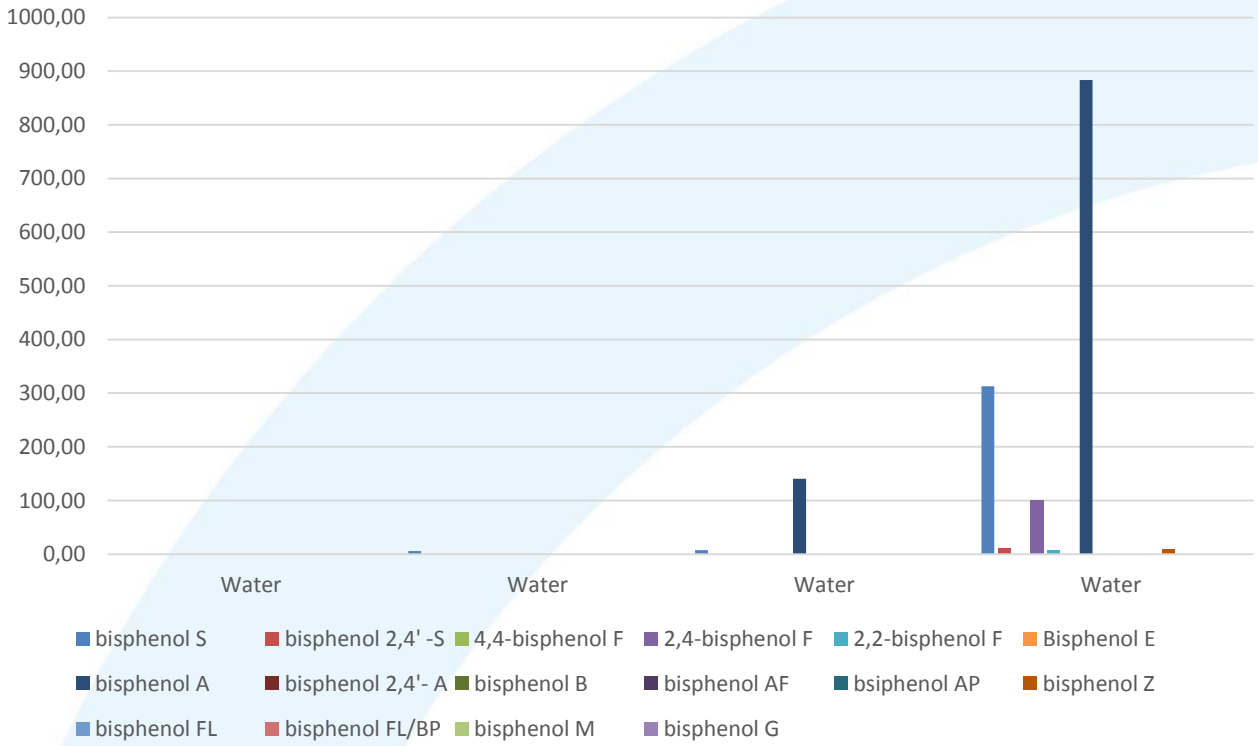
Bisphenols in water (ng/L)



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Bisphenols in polychaete

BPA <LOD to 57 ng/g
BPAF <LOD to 30ng/g
BPM <LOD to 40ng/g

Foto: Christian Schanche
http://www.fluefiskern.no/byttedyrene/borstemark.html

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Bisphenols in northern shrimp

BPA <LOD to 286 ng/g
BPG <LOD to 220 ng/g
BPF <LOD to 45ng/g

(photos: Sigurd Øxnevad, NIVA).

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Bisphenols in birds

Herring gull
Photo: Wikipedia

Blood: BPA <LOD to 24 ng/ml
BPB <LOD to 20 ng/ml
Egg: BBP <LOD to 2ng/g

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Summary

- A number of different bisphenol isomers has been detected
- Bisphenols tend to accumulate in earthworms
- Next to bisphenol A, bisphenol F and its isomers were occurring in most samples
- Concentrations are variable, should be monitored
- Important to check for TPs

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Thank you for your attention!

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