




Bisphenols

Jiří Palát

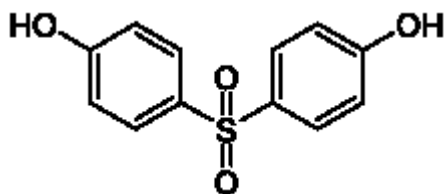
Modern Methods for Analyses of Organic Pollutants

Outline

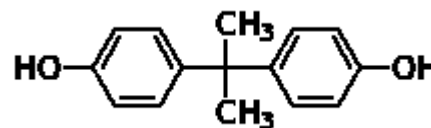
- ▶ Introduction
 - ▶ Applications of bisphenols
 - ▶ Bisphenol A and its alternatives
 - ▶ Exposure
 - ▶ Instrumental methods
 - ▶ Legislation
 - ▶ Conclusions
- 

What are BISPHENOLS?

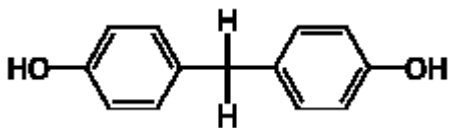
- ▶ Ubiquitous organic compounds with 2 hydroxyphenyl groups
- ▶ Bisphenol A – the most common
- ▶ Other important bisphenols – B, F, S
- ▶ Pseudo-persistent pollutants
- ▶ Endocrine disruptors



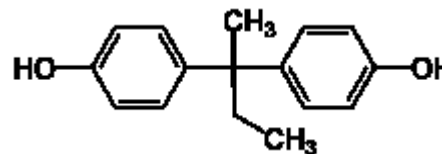
Bisphenol S



Bisphenol A



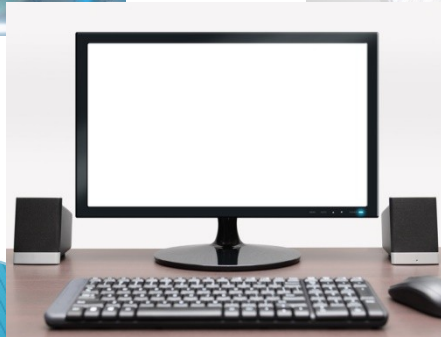
Bisphenol F



Bisphenol B

Applications of Bisphenols

- ▶ Basic building blocks for polycarbonate plastics (70%) and epoxy resins (30%)
- ▶ Polycarbonate plastics: returnable beverage bottles, infant feeding bottles, storage containers
- ▶ Epoxy resins: coatings and linings for food and beverage cans



Bisphenol A

- ▶ Use as monomer for plastic production since 1990s
- ▶ Global Bisphenol A production volume 2011: over 5 million tons
- ▶ Endocrine disruptor → estrogen activity
- ▶ Estrogen activity 5 times lower than 17 β -estradiol
- ▶ Adverse effects: impact on sexual development, reproduction potency, health effect (especially cancers of sexual organs but also cardiovascular diseases and diabetes)
- ▶ TDI by EFSA – 0,04 mg/kg of bodyweight per day
 - *TDI – tolerable daily intake
 - EFSA – European Food Safety Authority

Occurrence

- ▶ Detected in several matrices:

water

soils and sediments

sewage

indoor dust

food samples

beverages

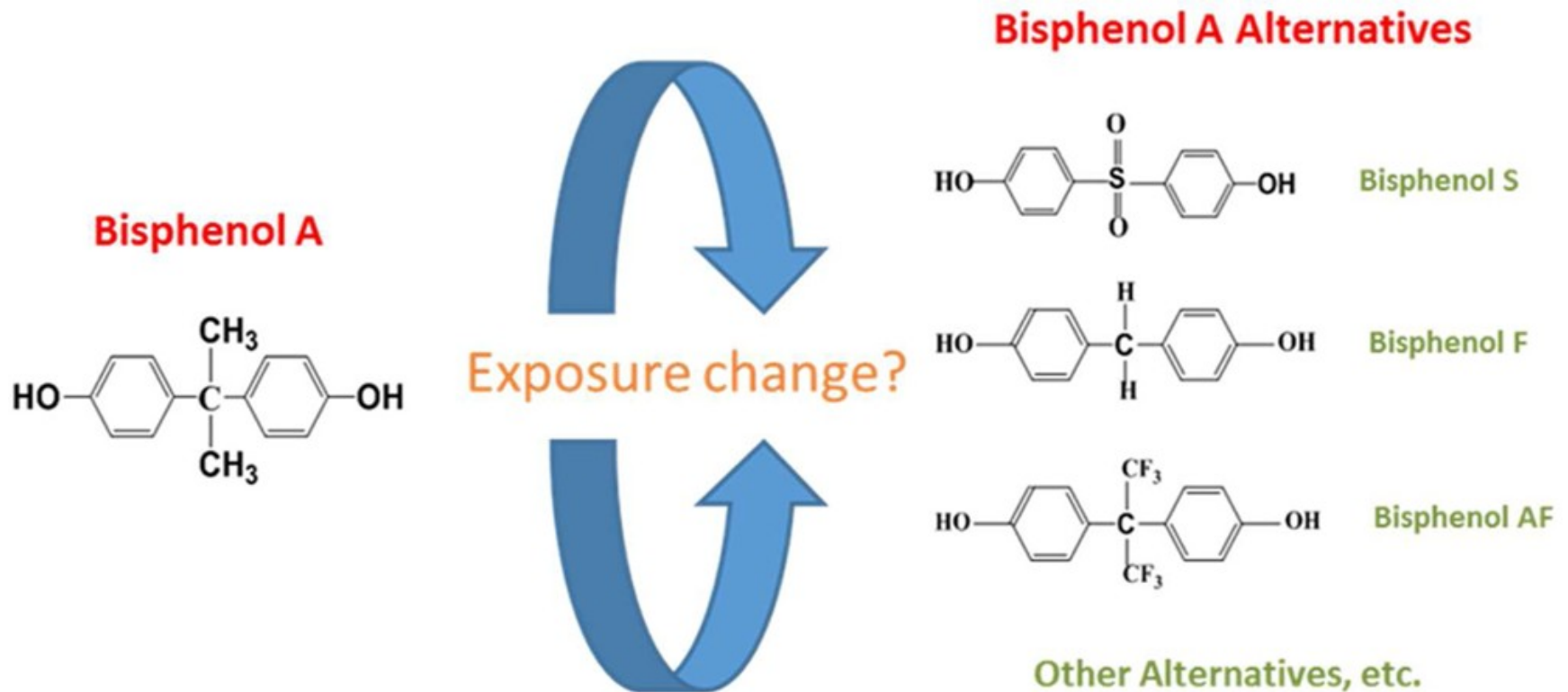
thermal paper

human blood, breast milk, urine

Bisphenol A – concentrations

Country	Sample size	Detection freq. (%)	Range	Refs.
Canned food (ng/g)				
US	78	91	<2-730	Noonan et al. (2011)
US	97	59	<0,2-65	Schechter et al. (2010)
Canada	78	99	<0,6-534	Cao et al. (2010)
Japan	48	92	<1-842	Sajiki et al. (2007)
Korea	61	64	<3-136	Lim et al. (2009a)
Belgium	21	100	0,2-169	Geens et al. (2010)
Beverage cans (ng/ml)				
Spain	11	64	<0,05-0,61	Gallard-Ayala et al. (2010)
Canada	69	100	0,03-4,5	Cao et al. (2009a)
Belgium	45	91	<0,02-8,1	Geens et al. (2010)
Portugal	30	70	<0,01-4,7	Cunha et al. (2011)

Bisphenol A alternatives



Bisphenol A alternatives

- ▶ Bisphenol S
 - Main alternative of bisphenol A
 - Higher thermal stability than bisphenol A
 - Use in production of baby bottles and thermal paper
- ▶ Bisphenol B
- ▶ Bisphenol F

How does BPA get into the body?

- ▶ Primary source through the diet
 - BPA in food and beverages accounts for the majority of daily human exposure
 - Leach into food from coatings and other consumer products
- ▶ Air, dust and water are other possible sources of exposure
- ▶ TDI by EFSA – 0,04 mg/kg of bodyweight per day

*TDI – tolerable daily intake

EFSA – European Food Safety Authority

Instrumental methods

- ▶ HPLC-MS
- ▶ HPLC-MS/MS
- ▶ GC-MS
- ▶ GC-MS/MS
 - With various ionization techniques

EU framework

- ▶ Regulation EU 10/2011 on plastic materials and food contact materials
 - BPA is permitted for use in food contact materials in the European Union (EU)
 - a national restriction on the use of BPA in all food contact materials – France
 - A national restrictions on the use of BPA in food contant materials for children – Sweden, Denmark, Belgium
- ▶ Directive 2011/8/EU restricting the use of bisphenol A in plastic infant feeding bottles


Bisphenol A under REACH

- ▶ Summer 2016 – demand to identify as an SVHC based on the reprotox 1B classification
- ▶ August 2016 - reprotox 1B classification entered into force
- ▶ March 2018 - reprotox 1B for BPA will apply


- ▶ Not for BPA as an intermediate!
- ▶ Not direct impact for manufacture uses of BPA (polycarbonate materials)

*SVHC – substances of very high concern

What can I do to prevent exposure of BPA?

- ▶ Don't microwave polycarbonate plastic food containers
 - ▶ Reduce your use of canned foods
 - ▶ Choose glass, porcelain or stainless steel containers
 - ▶ Use BPA free baby bottles
- 

Conclusions

- ▶ Widespread problem - BPA and its alternatives deserve special attention
 - ▶ Much more focus on analysis in human matrices
 - ▶ Focus on toxicological effects of bisphenols, especially on its alternatives
 - ▶ Really lack of data on toxicological informations of alternatives
- 

Thanks for your attention!

Any questions?

