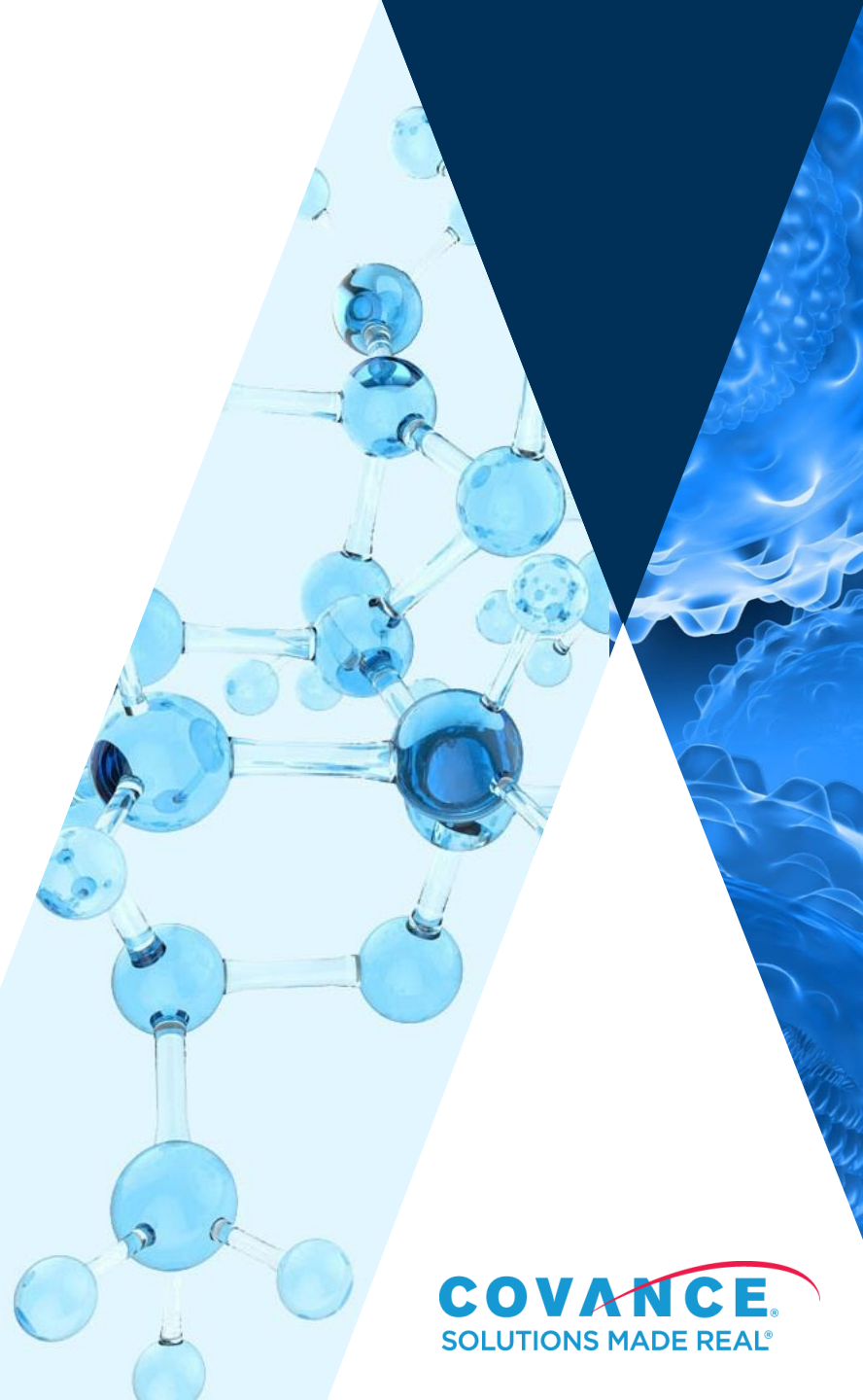


# BISPHENOL A

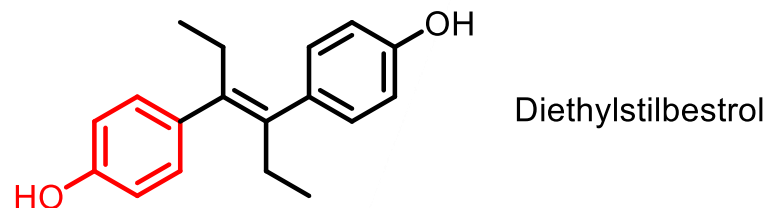
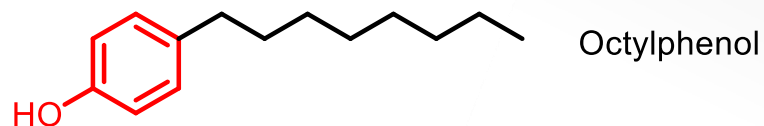
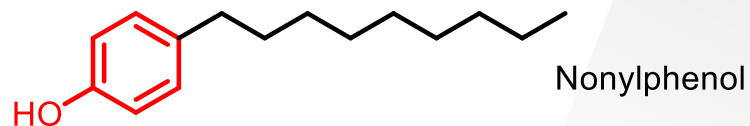
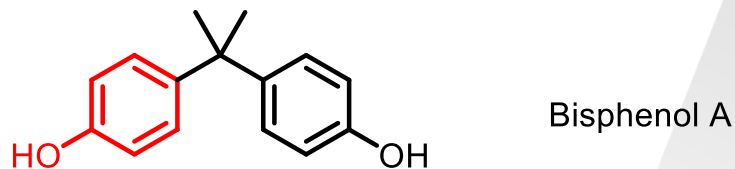
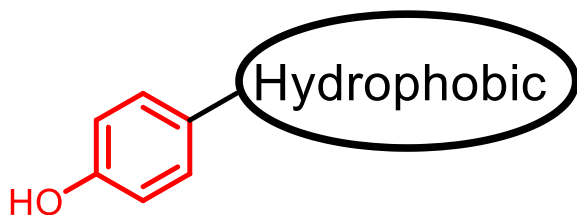
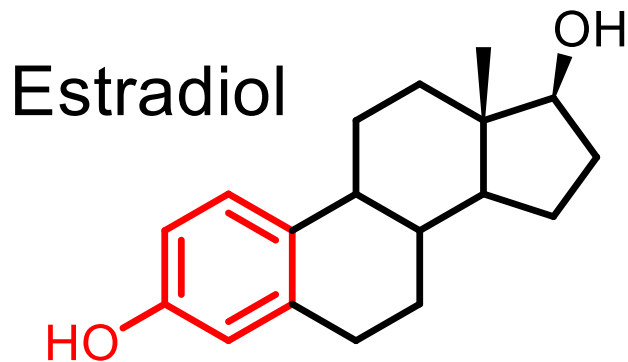
Katerina Mastovska

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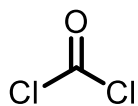
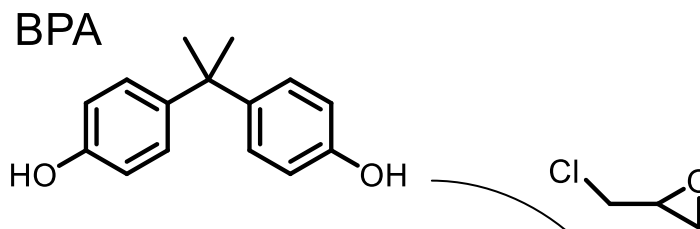


# Estrogenic Endocrine Disrupting Compounds

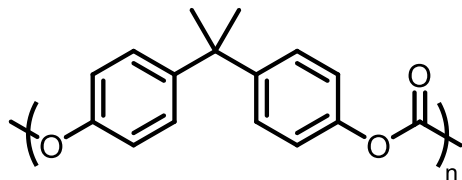
## EDCs with estrogenic activity



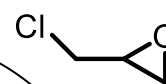
# Bisphenol A (BPA)



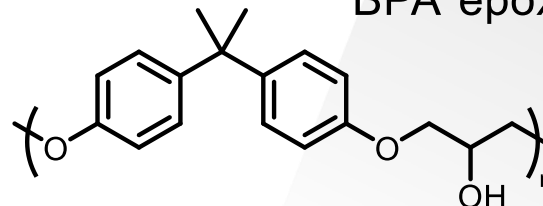
Polycarbonate



**Polycarbonate plastic**



BPA epoxy resin



**Epoxy resins (can lining)**



*Food contact materials*

# Bisphenol A (BPA) - EU and US Regulations

- EU Regulation No 10/2011 on plastic food contact materials: specific migration limit (SML) for BPA at 0.6 mg/kg in food
- EU Regulation No 321/2011: BPA not to be used for the manufacture of polycarbonate infant feeding bottles
- BPA-based materials no longer to be used in baby bottles, sippy cups, and infant formula packaging (FDA: 2012, 2013)
- Listed in California Proposition 65 (2013)
- Tolerable daily intake (TDI): 50 µg/kg bw (EFSA, 2006) reduced to **temporary TDI of 4 µg/kg bw** (EFSA, 2015)
- EU Regulation No 2018/213: Additional ban on the BPA use in the manufacture of sippy cups and **SML reduced to 0.05 mg/kg**, except for infant and baby food (< LOD of 0.01 mg/kg)



# AOAC SMPR 2017.018

“Determination of BPA in Commercially Packaged Ready-to-Consume Carbonated and Non-Carbonated Water and Non-Alcoholic Beverages”

SMPR = Standard Method Performance Requirements

<b>Limit of Detection (LOD)</b>	$\leq 0.1 \mu\text{g/L}$
<b>Limit of Quantitation (LOQ)</b>	$\leq 0.5 \mu\text{g/L}$
<b>Target Matrices</b>	Carbonated soft drinks, regular Carbonated soft drinks, diet 100% Juices, with pulp 100% Juices, without pulp Teas Dairy-based coffee drinks Sports drinks Energy drinks Grain-based beverages Meal replacement beverages



# AOAC SMPR 2017.018

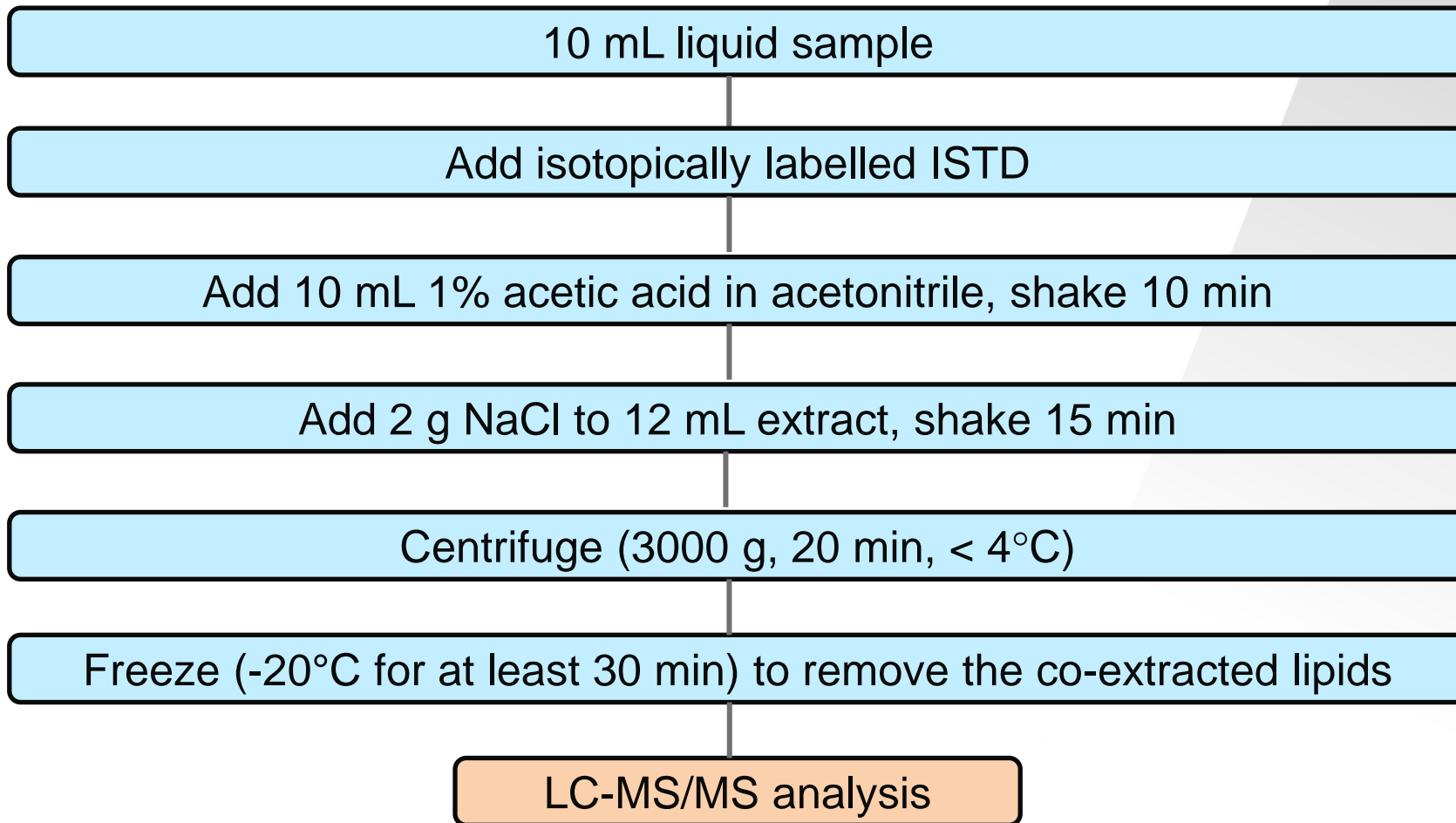
“Determination of BPA in Commercially Packaged Ready-to-Consume Carbonated and Non-Carbonated Water and Non-Alcoholic Beverages”

SMPR = Standard Method Performance Requirements

Analytical range*	< 2 µg/L	2 – 5 µg/L	> 5 – 20 µg/L
Accuracy	60 – 140%	80 – 120%	80 – 120%
RSD <sub>r</sub>	≤ 20%	≤ 10%	≤ 5%
RSD <sub>R</sub>	≤ 40%	≤ 20%	≤ 10%

\*Concentration in the ready-to-drink product.

# AOAC First Action Official Method 2017.15



# Method Validation – BPA in Beverages

Validation scheme: 3 replicates, 2 different analysts, 3 different days ( $n = 9$ )

Matrix	Mean Recovery (%)			%RSD <sub>i</sub> (0.3 µg/L)
	0.3 µg/L	1.5 µg/L	20 µg/L	
Regular carbonated soft drink	95.6	102.0	99.8	7.5
Diet carbonated soft drink	92.4	96.8	100.8	7.5
Juice, with pulp	95.0	98.5	102.5	11.1
Juice, without pulp	93.1	98.1	96.9	3.0
Tea	99.1	101.9	98.9	6.0
Dairy-based coffee drink	98.6	102.4	100.5	10.1
Sports drink	95.7	101.0	101.3	5.7
Energy drink	84.7	95.0	98.5	5.7
Grain-based beverage	96.5	96.5	100.2	6.7
Meal replacement beverage	95.1	102.7	103.2	7.1
Ready-to-feed infant formula	102.8	98.2	95.7	6.3



# Method Performance vs. AOAC SMPR 2017.018

	AOAC SMPR	This method	
Limit of Detection (LOD)	$\leq 0.1 \mu\text{g/L}$	0.087 $\mu\text{g/L}$	✓
Limit of Quantitation (LOQ)	$\leq 0.5 \mu\text{g/L}$	0.3 $\mu\text{g/L}$	✓
Analytical range	0.5 – 20 $\mu\text{g/L}$	0.3 – 20 $\mu\text{g/L}$	✓
Accuracy (< 2 $\mu\text{g/L}$ )	60 – 140%	76.5 – 115%	✓
Accuracy (2 – 20 $\mu\text{g/L}$ )	80 – 120%	90.9 – 109%	✓
% RSD <sub>r</sub> (< 2 $\mu\text{g/L}$ )	$\leq 20\%$	0.2 – 11%	✓
% RSD <sub>r</sub> (5 – 20 $\mu\text{g/L}$ )	$\leq 5\%$	0.2 – 4.4%	✓

**Approved AOAC First Action Official method 2017.15  
for BPA analysis in beverages**

S. Li, J. Shippar, K. Mastovska, *J. AOAC Int.* DOI: [10.5740/jaoacint.18-0132](https://doi.org/10.5740/jaoacint.18-0132)

# Collaborative Study – Proposed Design

- 4 matrices: regular carbonated soft drink, 100% juice with pulp, energy drink and dairy-based coffee drink
- Concentration range: 0.3 - 20 µg/L
- 3 concentration levels (blind duplicates) per sample matrix + blank
- Qualification phase:
  - Calibration Range Test: To optimize the LC-MS conditions, determine linear range, and test carry-over.
  - Procedure Blank Test
  - Low-Level Spike Test at 0.3 µg/L
  - Practice Samples



Please contact us if you are interested in participating in the AOAC collaborative study on BPA in beverages

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