

Biomonitoring of 13 endocrine disrupting chemicals in Walloon population using hair as matrix

Julien Claessens, Catherine Pirard, Corinne Charlier

Laboratory of Clinical, Forensic, Industrial and Environmental Toxicology, University of Liege (ULiege), CHU (B35), 4000 Liege, Belgium

INTRODUCTION

Endocrine disrupting chemical (EDC)

“An endocrine disruptor is an exogenous substance or mixture that alters function(s) of the endocrine system and consequently causes adverse health effects in an intact organism, or its progeny, or (sub) populations” (WHO 2002)

Biomonitoring

Biomonitoring of EDCs is generally performed in two matrix

BLOOD

URINE

Biomonitoring of non-persistent organic pollutants is subject to misclassifications due to:

- Short biological half-life
- Changes in exposure behaviour
- Time between exposure and sample collection

Number of samples needed to reduce the risk of misclassification is unknown, researchers have started studying alternative matrix such as hair

Hair as matrix

Advantages

- Easiness of sampling
- Sample conservation
- Memory effect
- Retrospective analysis

Limitations

- External contamination
- Absence of reference materials/blank matrix
- No standardized decontamination procedure
- Influence of hair length, coloration and treatment

Scope

- Validate UPLC-MS/MS method for hair biomonitoring of 13 EDCs including 2 bisphenols, 3 parabens, 8 perfluoroalkyl compounds
- Assessing concentration levels in adult Walloon population

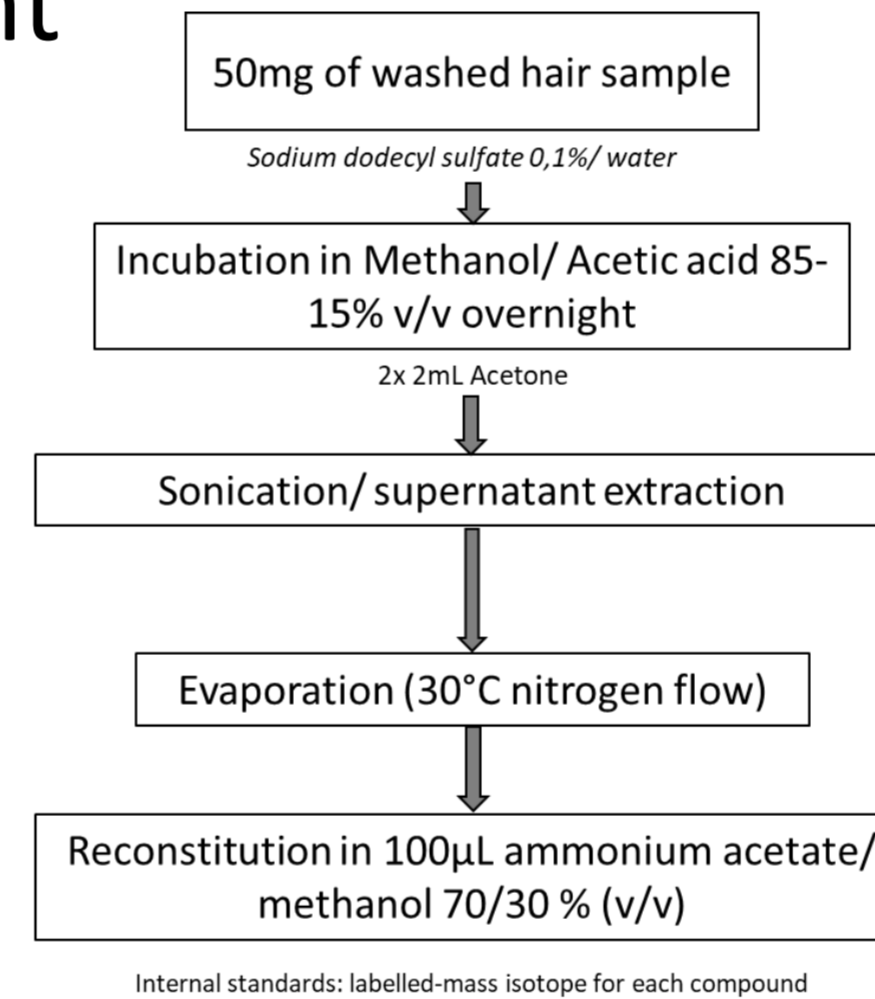
MATERIALS AND METHODS

Population (114 volunteers)

Population characteristics			
		Number	Frequency
Age			
Gender	male	49	43%
	female	65	57%
Smoking status	smoker	3	3%
	Non-smoker	111	97%
Hair length	short	51	45%
	medium	23	20%
	long	40	35%
Hair treatment	none	88	77%
	dyeing	8	7%
	discoloration	18	16%

Samples Treatment

Hair samples were collected at the occipital vertex, stocked at ambient temperature and protected from light



Analytical parameters

Compounds	RT (Min)	Precursor ion (m/z)	Quantifier (m/z)	Qualifier (m/z)	LOD (pg/mg)	LOQ (pg/mg)
BPS	2,15	249,0	108,0	92,1	0,60	2,00
MeP	3,03	151,0	92,0	136,0	3,03	10,00
PFPeA	3,94	262,8	218,8	140,9	0,09	0,32
EtP	5,32	165,0	92,0	137,0	0,60	2,00
PFHxA	7,47	312,8	268,8	118,9	0,06	0,20
PrP	8,36	178,9	92,0	136	3,03	10,00
BPA	9,21	227,1	212,1	133	3,03	10,00
PFHpA	10,06	362,8	168,9	118,9	0,06	0,20
PFHxS	10,37	399,1	98,8	79,8	0,06	0,20
PFOA	11,76	412,9	368,9	168,9	0,06	0,20
PFNA	12,98	462,8	418,8	218,8	0,06	0,20
PFOS	13,03	498,3	78,8	97,8	3,88	10,00
PFDA	14,06	512,8	468,8	218,9	0,08	0,27

RESULTS AND DISCUSSION

	DF (%)	QF (%)	Geometric Mean (pg/mg)	Arithmetic mean (pg/mg)	Min (pg/mg)	25% (pg/mg)	median (pg/mg)	75% (pg/mg)	Max (pg/mg)
BPA	97,4	93,9	46,1	72,4	<LOQ	21,7	46,6	88,8	587,1
BPS	99,1	97,4	32,8	95,2	<LOQ	15,4	31,9	62,4	2298,0
MeP	100,0	94,7	104,2	2326,0	<LOQ	24,1	58,9	204,8	51307,0
EtP	87,7	66,7	8,7	501,5	<LOQ	<LOQ	5,2	16,7	26967,7
PrP	78,1	54,8	22,9	81,5	<LOQ	<LOQ	16,4	61,6	3,4
PFOA	86,8	46,4	<LOQ	0,2	<LOQ	<LOQ	<LOQ	0,3	1517,1
PFHxA	18,4	5,3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	2,4
PFPeA	6,1	0,0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
PFHpA	4,4	1,8	<LOQ	0,2	<LOQ	<LOQ	<LOQ	<LOQ	1,4
PFHxS	11,4	2,6	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	18,8
PFNA	43,9	19,3	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	1,7
PFOS	0,9	0,9	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	11,3
PFDA	0,0	0,0	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ

- BPA, BPS, MeP, EtP, PrP and PFOA were detected in large majority of samples (from 78,1% to 100% DF)
- PFHxA, PFPeA, PFHpA, PFHxS, PFNA, PFOS, PFDA were rarely detected and quantified, suggesting that our LOQ was higher than detectable concentrations in hair
- Significant correlation was found between age and PrP concentration, no significant differences were highlighted between gender, while no statistics were performed on influence of smoking status
- Influence of hair treatments and hair length were assessed using Kruskal-Wallis test. No differences between sub-groups were observed for hair length or treatment

CONCLUSION

Analytical method validated for hair analysis of 13 EDCs

Biomonitoring performed to establish baseline contamination levels

High detection frequencies showed for BPA, MeP, BPS, EtP, PrP, PFOA (from 78,07 to 100%)

Low detection frequencies highlighted for other PFCs, indicating of an inappropriate LOQ

Results indicate that hair is a promising matrix for biomonitoring of environmental pollutants