INFLAME 2nd Network Assembly Meeting, 3rd Supervisory Board Meeting, 25th April 2012

Migration Pathways to the environment

”Horizon Scanning” for FRs present in e-waste

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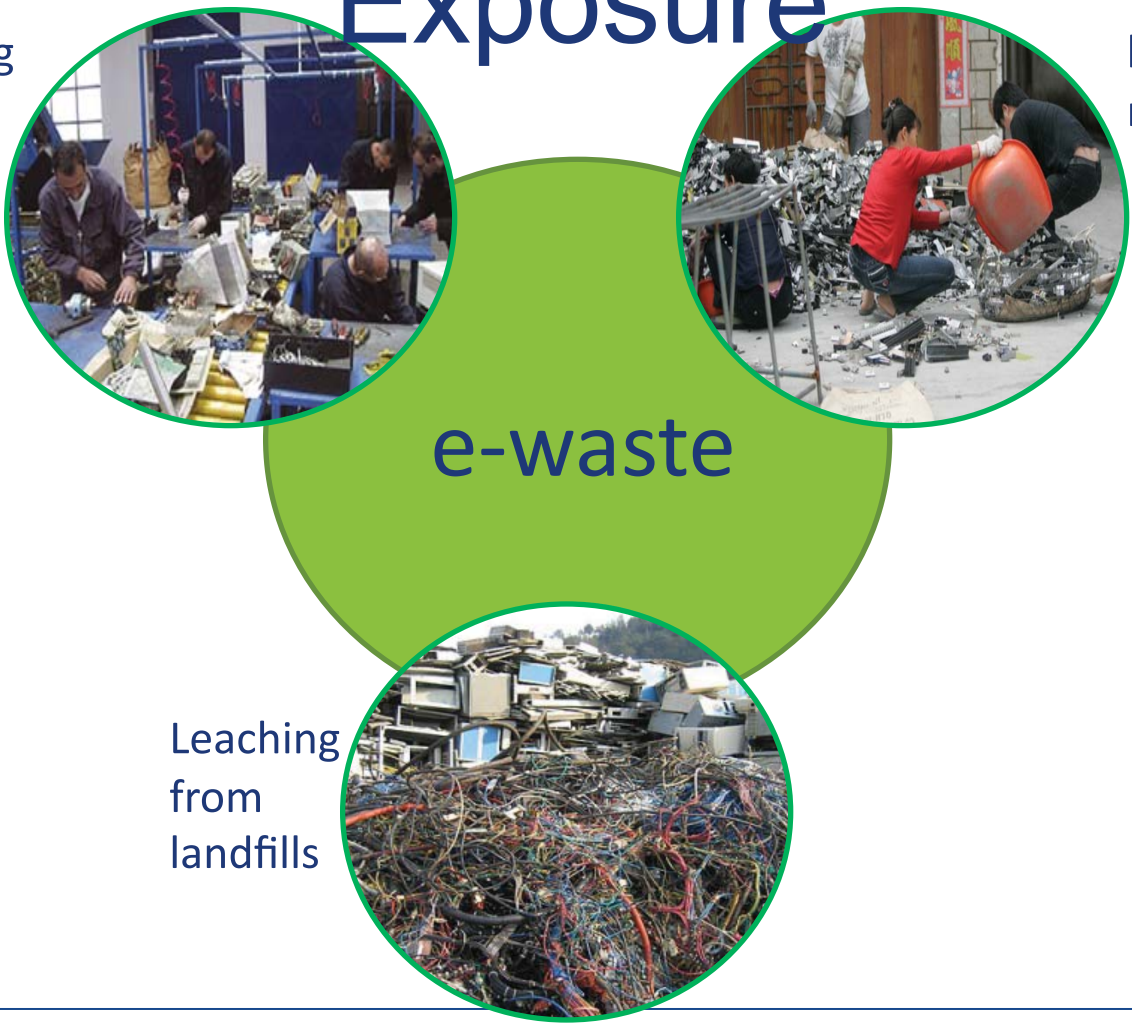
- Analysis of Bisphenol A in urine samples (SPE, LC-QQQ MS), collaboration with a Medical Spanish Research Center in Catalonia (CREAL)
- Development of extraction/clean-up methods for acrylamide/ELISA kits (ABRAXIS LLC, Pennsylvania)
- Development of extraction/clean-up methods for PFASs in food (PERFOOD project) Supervision Dr. Stefan van Leeuwen. Summer 2009, VU University
- Review articles (e.g. Ballesteros Gómez, Rubio Bravo, Soledad, *Recent Advanced in Environmental Analysis,* Analytical Chemistry, 83 (2011) 4579-4613)

PhD at University of Córdoba, Analytical Chemistry Department

e-waste background

- Most polymer electronic materials contain flame retardants, often with halogens
- Globally e-waste growing by about 40 million tons a year
- > 1 billion mobile phones sold worldwide in 2007
- e-waste can end up in landfills
    - >4.6 million tons in US landfills in 2000
    - Hong Kong, 10-20 percent of discarded computers go to landfill
- Regulations:
    - Convention of Basel to control hazardous waste between countries, e.g. to prevent electronic waste being dumped in landfills due to its hazardous content
    - In practice dumping continues in many countries

Exposure



Recycling facilities

backyard recycling

e-waste

Leaching from landfills

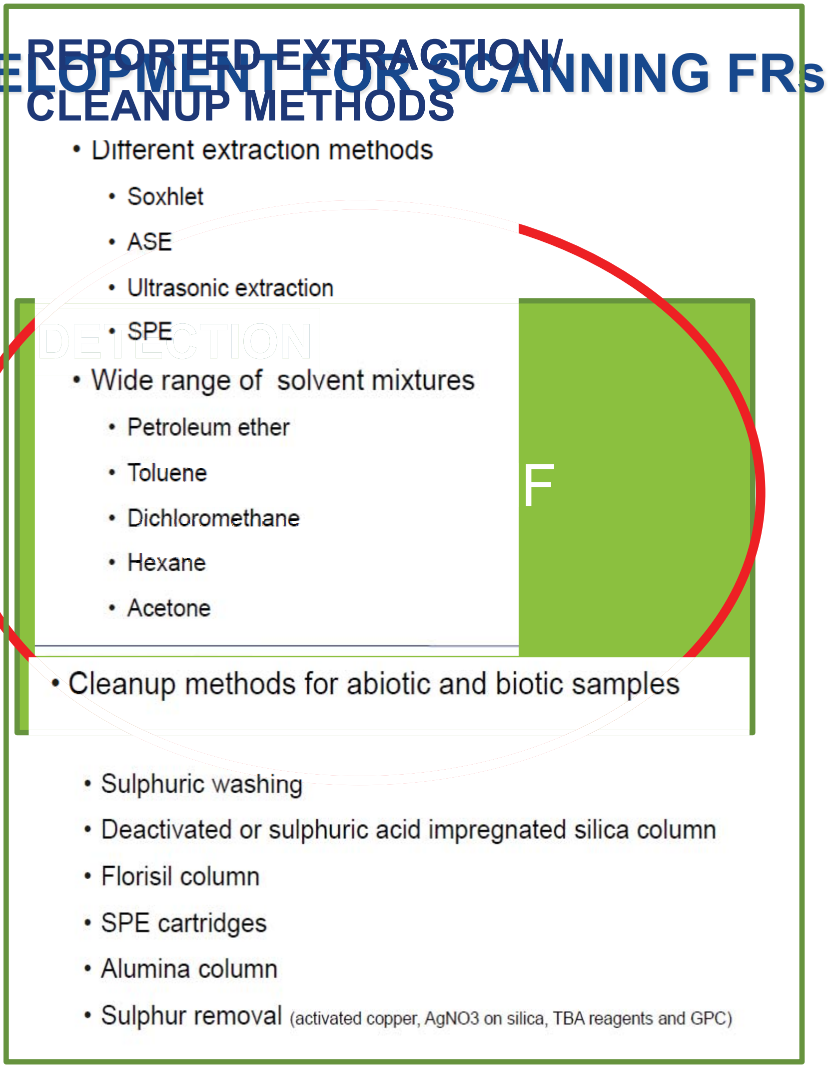
Objectives ER1

- To study the mechanisms via which FRs migrate from e-waste
  - Develop analytical screening methods for "established" (PBDEs, TBBPA, HBCD), novel (BDBPE, DBDPE, TBB, TBPH, PBT), alternative (PFRs) and unknown FRs (e.g. degradation products)
  - Horizon scanning e-waste
    - Occurrence, leaching (field and lab)
  - Hazard of e-waste
    - Toxicity profiling (e.g. microsomes)

ANALYTICAL METHODS DEVELOPMENT FOR SCANNING FRs

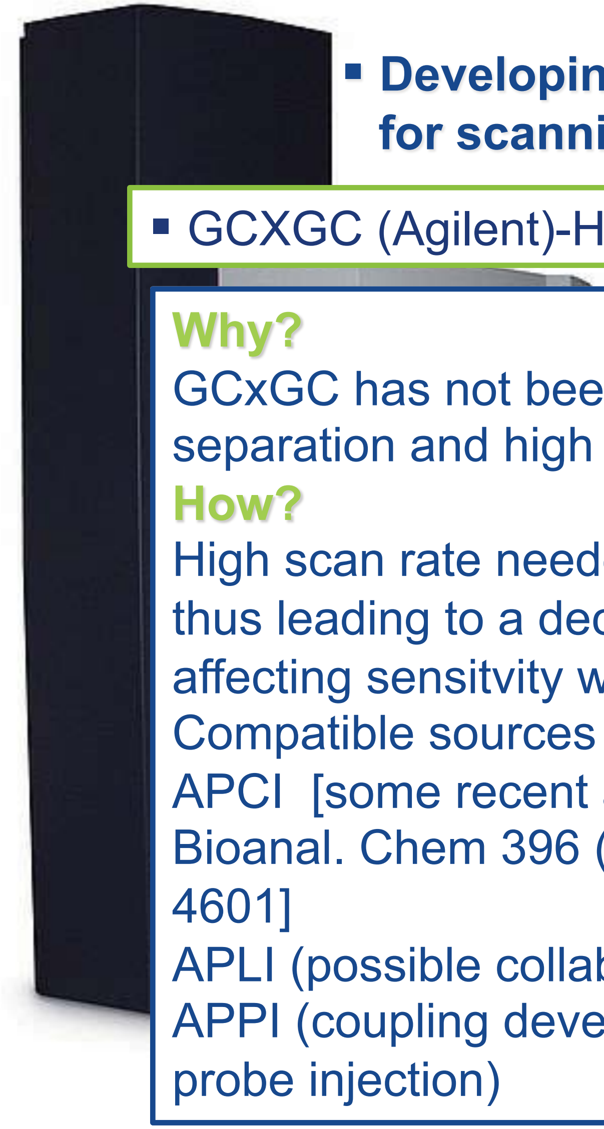
EXTRACTION

Simplifying sample treatment: dispersive SPE, QUECHERS, surfactant-based extraction



REPORTED EXTRACTION/ CLEANUP METHODS

- Different extraction methods
  - Soxhlet
  - ASE
  - Ultrasonic extraction
  - SPE
- Wide range of solvent mixtures
  - Petroleum ether
  - Toluene
  - Dichloromethane
  - Hexane
  - Acetone
- Cleanup methods for abiotic and biotic samples
  - Sulphuric washing
  - Deactivated or sulphuric acid impregnated silica column
  - Florisil column
  - SPE cartridges
  - Alumina column
  - Sulphur removal (activated copper, AgNO3 on silica, TBA reagents and GPC)



- **Developing comprehensive separation/detection methods for scanning FRs**

- GCXGC (Agilent)-HRTOF(Brukers)

Why?

GCxGC has not been coupled before to HRTOF to combine enhanced separation and high mass accuracy for identification

How?

High scan rate needed (20-30Hz) due to narrow peaks coming from GCxGC thus leading to a decrease in sensitivity, so optimization of TOF parameters affecting sensitvity will be carried in depth

Compatible sources commercially available will be checked

APCI [some recent articles propose it as suitable for BRFs, Zhou et al. Anal. Bioanal. Chem 396 (2010); Mascolo et al. J. Chromatogr.A 1217 (2010) 4601]

APLI (possible collaboration)

APPI (coupling development needed, only commercially available for direct probe injection)

- **Developing comprehensive separation/detection limits for scanning FRs: Other options**

- GC-QTOF
- LC (Agilent)-ESI/APCI /APPI-HRTOF(Bruckers)
- LC-QTOF (University of Antwerp)
- APPI , APCI direct probe-HRTOF
- LC-QTRAP for full scan/MRM/MS^n combined experiments (University of Cordoba)

THANK YOU FOR YOUR ATTENTION!