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Testing recovery of a metal from a sample material in laboratory scale at UEF

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EASTERN FINLAND

This activity has received funding from the European Institute of Innovation and Technology (EIT), a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation

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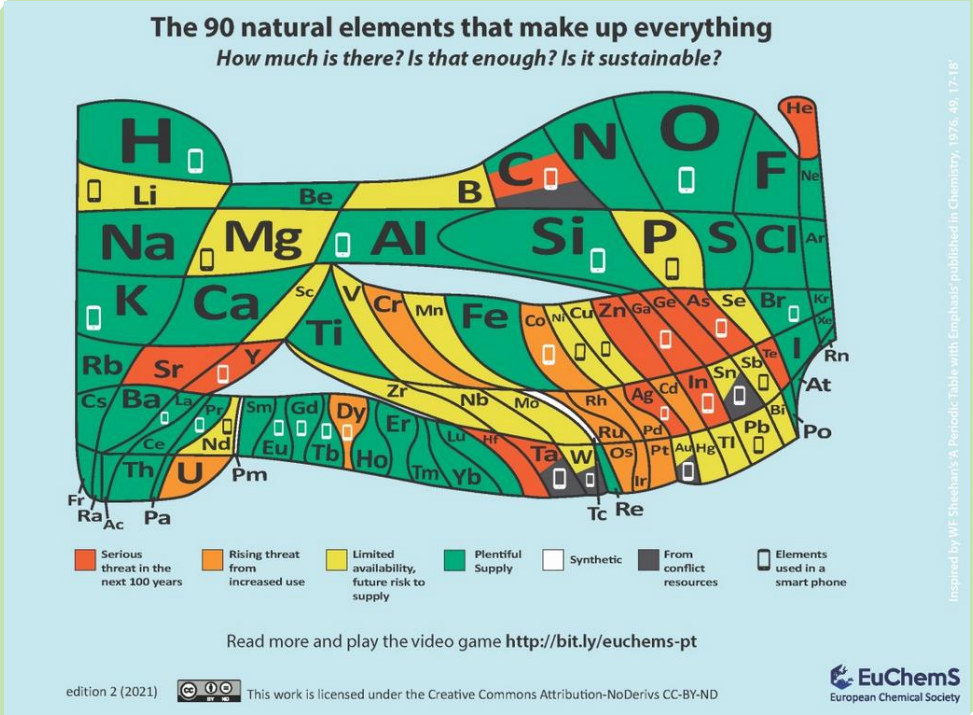
Content of the presentation

- Characterization of available sample(s)
- Selection of recovery method(s) for laboratory tests
- Testing element recovery in laboratory
- Analytical chemistry possibilities at UEF



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Examples of sample material(s)

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Aqueous solutions:

- Process waste solutions
- Seepage waters
- AMD…

Solids:

- Process wastes
- Tailings sands
- Water treatment sludges
- Ores
- (E-wastes, Ashes…)

What should we know from available sample material?

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Characterization of available sample(s)

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- Representativeness of the sample source
- Elemental composition
- Presence of toxic/harmful substances
- Element of interest: dissolved – precipitated – embedded in crystals or crystal structure
- Stability
- Variation of composition
- Special features, pH, particle size…

Generally: “The more you know the better”

How much there is an element of interest for recovery? What else sample material contains?...

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Selection of recovery method(s) for laboratory tests

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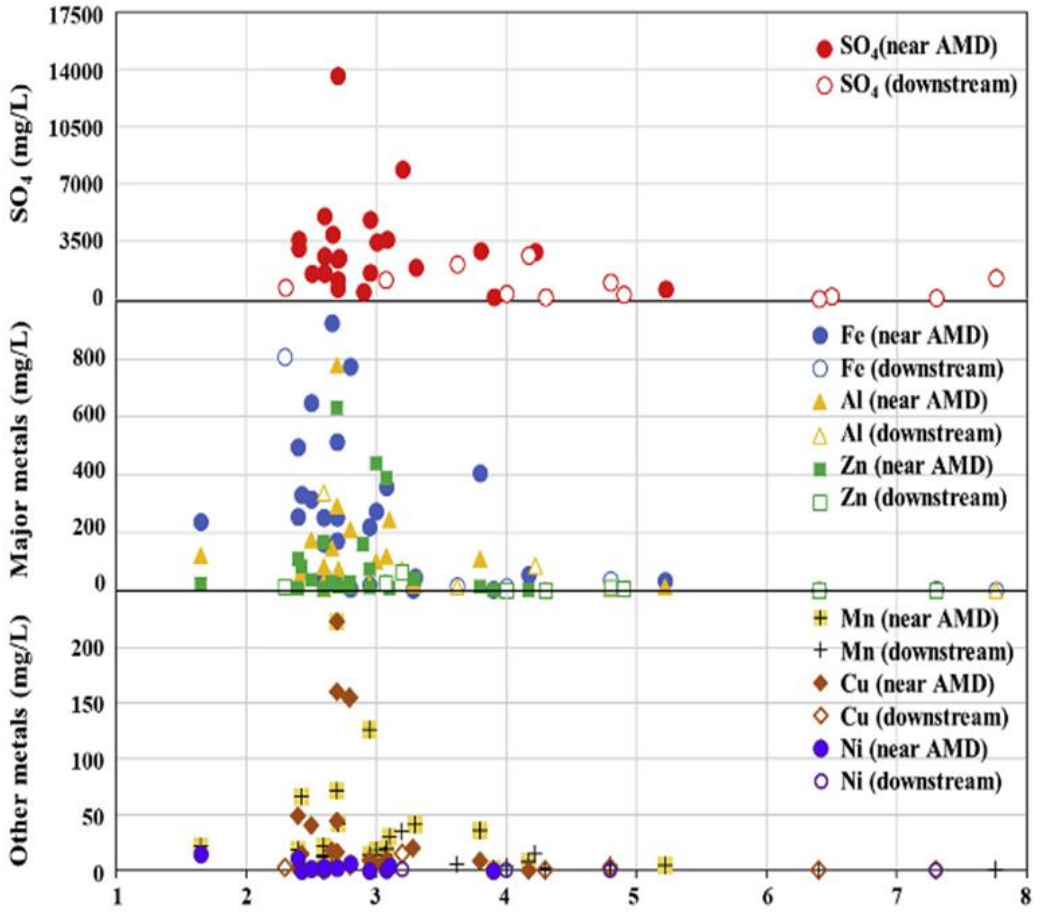
- Valuable elements exist often in significantly lower concentration compared to major metals.
- It is hard to selectively separate scarce elements from dominant metals.
- Seepage water/AMD or solid material may be chemically unstable – e.g. oxidation, crystal growth, microbes …



Naidu and co-workers 2019

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Selection of recovery method(s) for laboratory tests

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- Element of interest may be part of several chemical compounds and/or embedded in crystals.
- Selective precipitation or adsorption.
- Partial leaching vs. total dissolution.
- No additional harmful waste.
- Cheap basic chemicals & simple process.

→ Strategy how to try to recover element of interest

Precipitation, adosrption, leaching, solid/liquid separation…

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Testing recovery in laboratory

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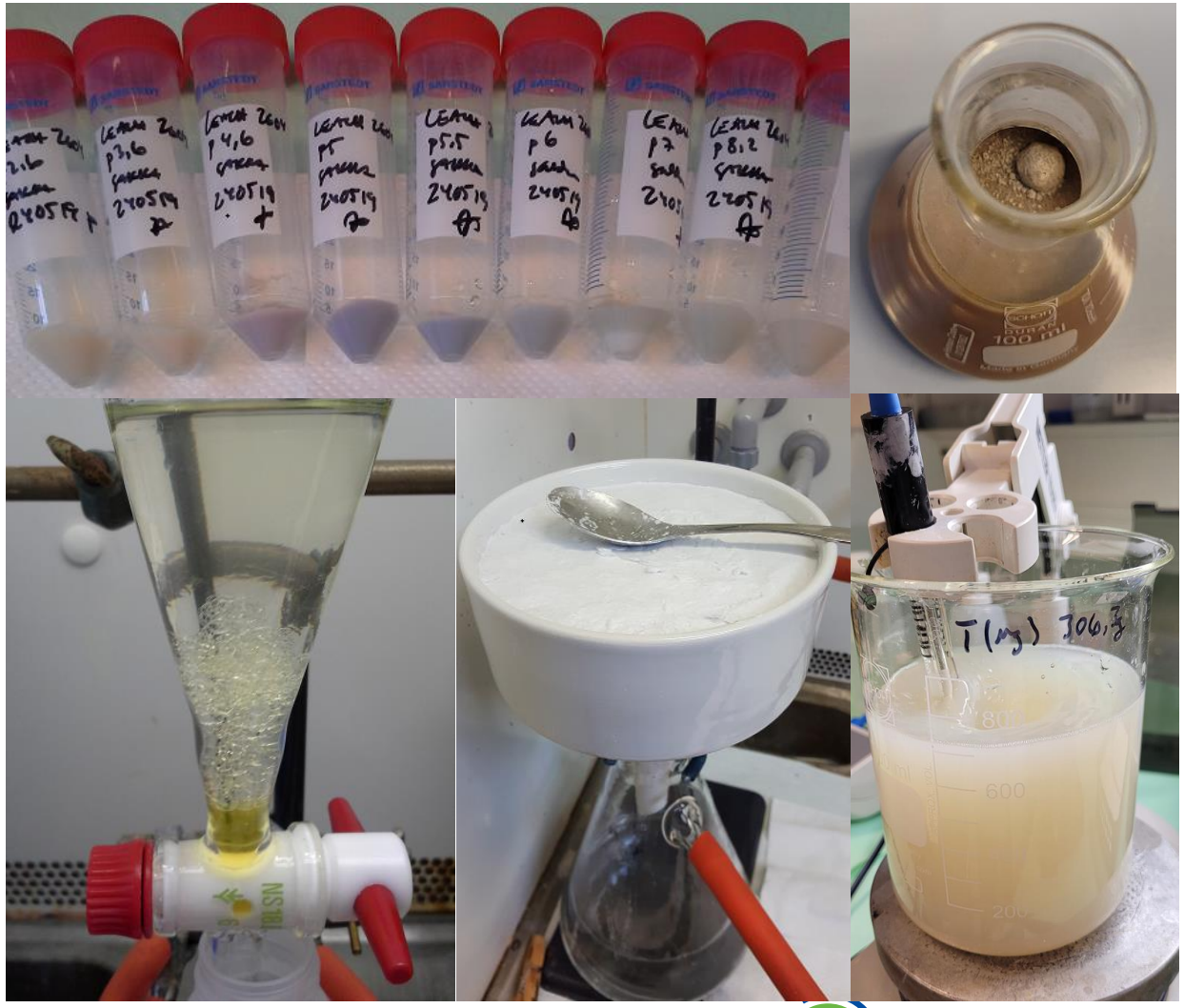
Chemicals needed, unit processes needed, pH, temperature, L/S ratio, reaction time, sample matrix, impurities…



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Testing recovery in laboratory

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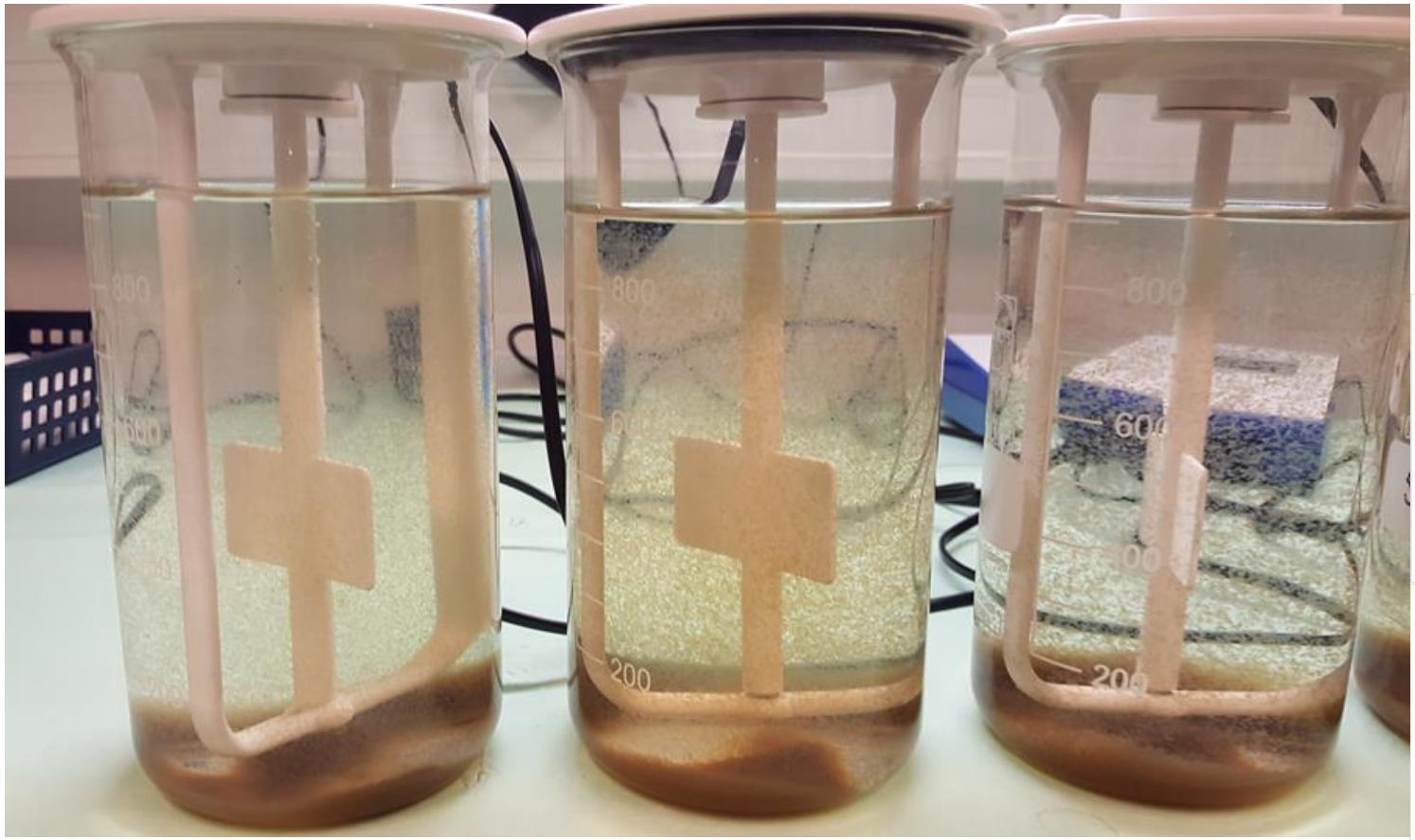

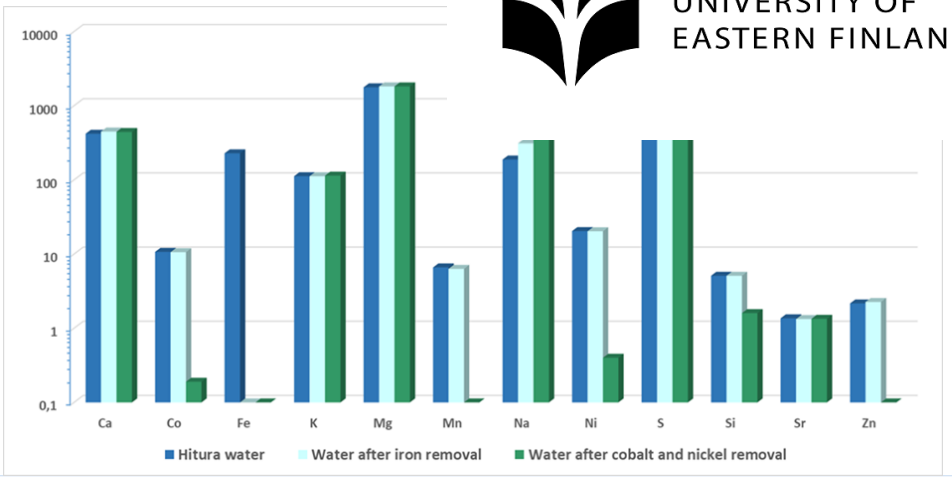

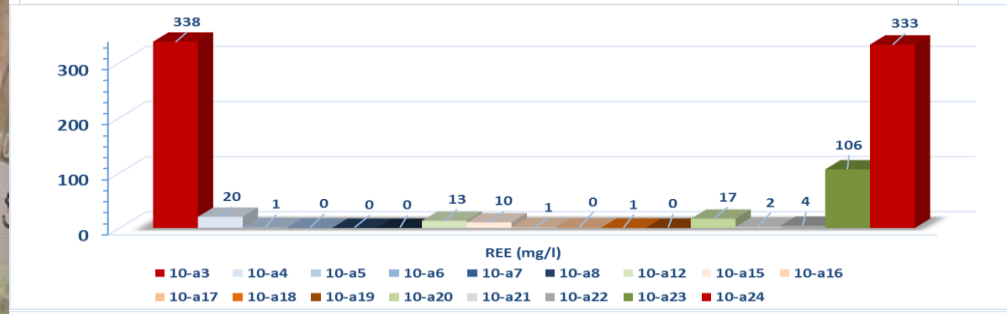

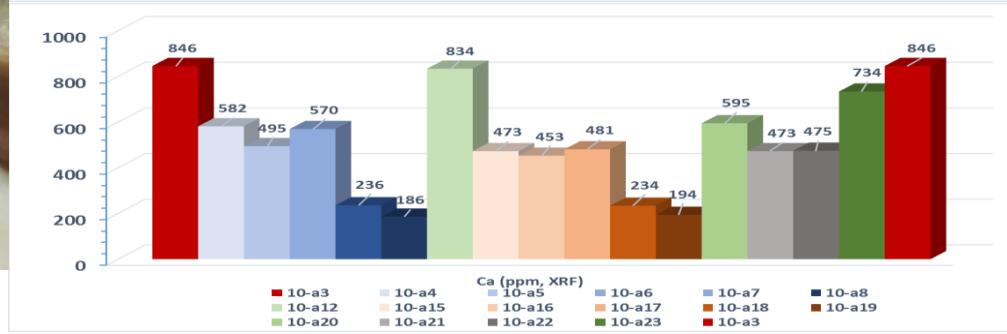

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Analytical chemistry at UEF – elements:

- Elements from Li to U down to ppt level if needed.
- Variable matrix from living organisms to rocks.
- Costs depending on case and number of samples.

TXRF

MP-AES

ICP-MS

Ho 165 (ug/L)	Er 166 (ug/L)	Tm 169 (ug/L)
94,3	171	12,0
51,7	95,7	6,8
31,7	58,6	3,9
24,1	45,6	3,2
91,5	167	11,9
53,2	96,4	6,7
30,9	56,1	3,9
23,3	42,6	3,0

Costs 1 / 100 sample

TXRF 20-100 Eur (1)

TXRF 500-4000 Eur (100)

MP AES 20-100 Eur (1)

MP AES 800-6000 Eur (100)

ICP MS 200 Eur (1)

ICP MS 3000-6000 Eur (100)

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Analytical chemistry at UEF – organic compounds:

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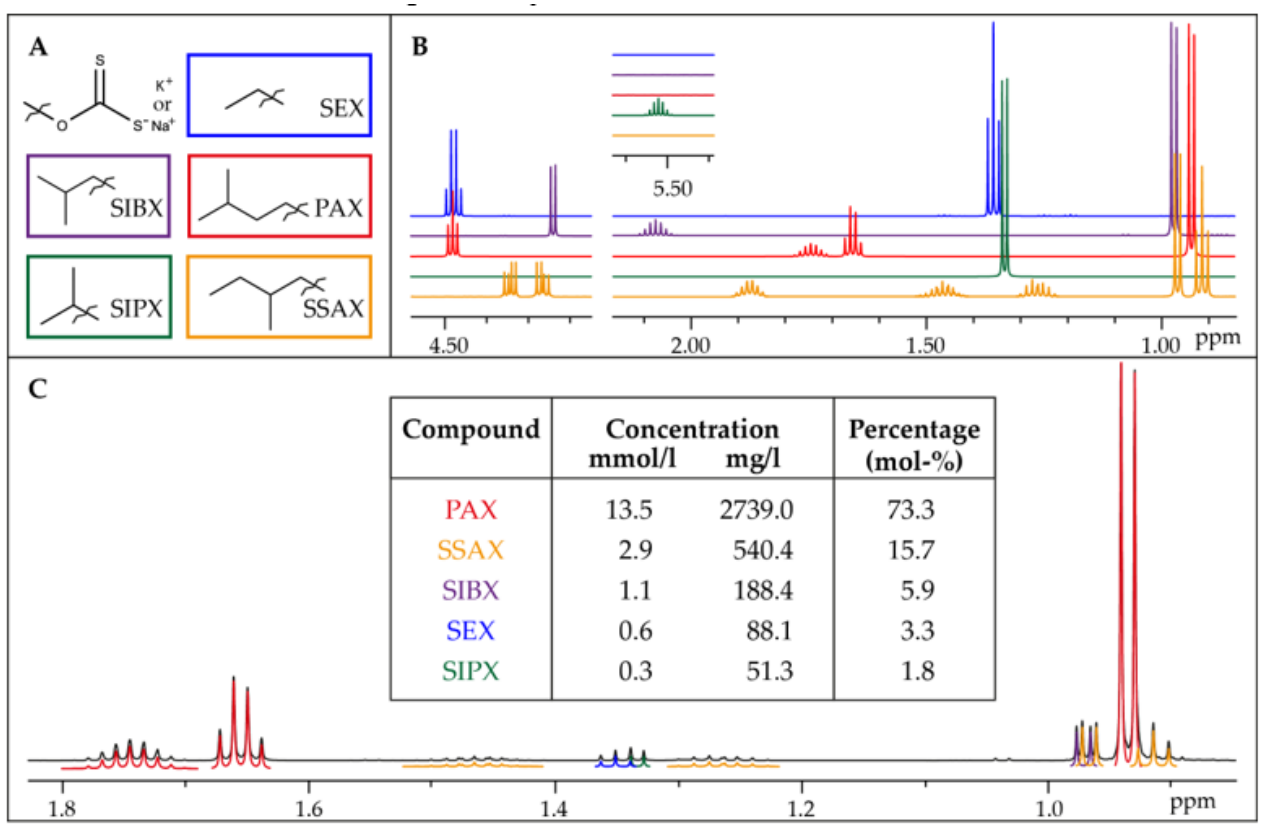
- **Identification and quantification of organic compounds, e.g. xanthates, either from bulky compounds or from environmental samples down to ppm level.**



Compound	Concentration mmol/l	Concentration mg/l	Percentage (mol-%)
PAX	13.5	2739.0	73.3
SSAX	2.9	540.4	15.7
SIBX	1.1	188.4	5.9
SEX	0.6	88.1	3.3
SIPX	0.3	51.3	1.8

Costs 1 / 100 sample

NMR 400 Eur (1)

NMR 2 000-10 000 Eur (100)

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