

# Some innovative approaches in environmental analysis of oil shale wastes and discharges

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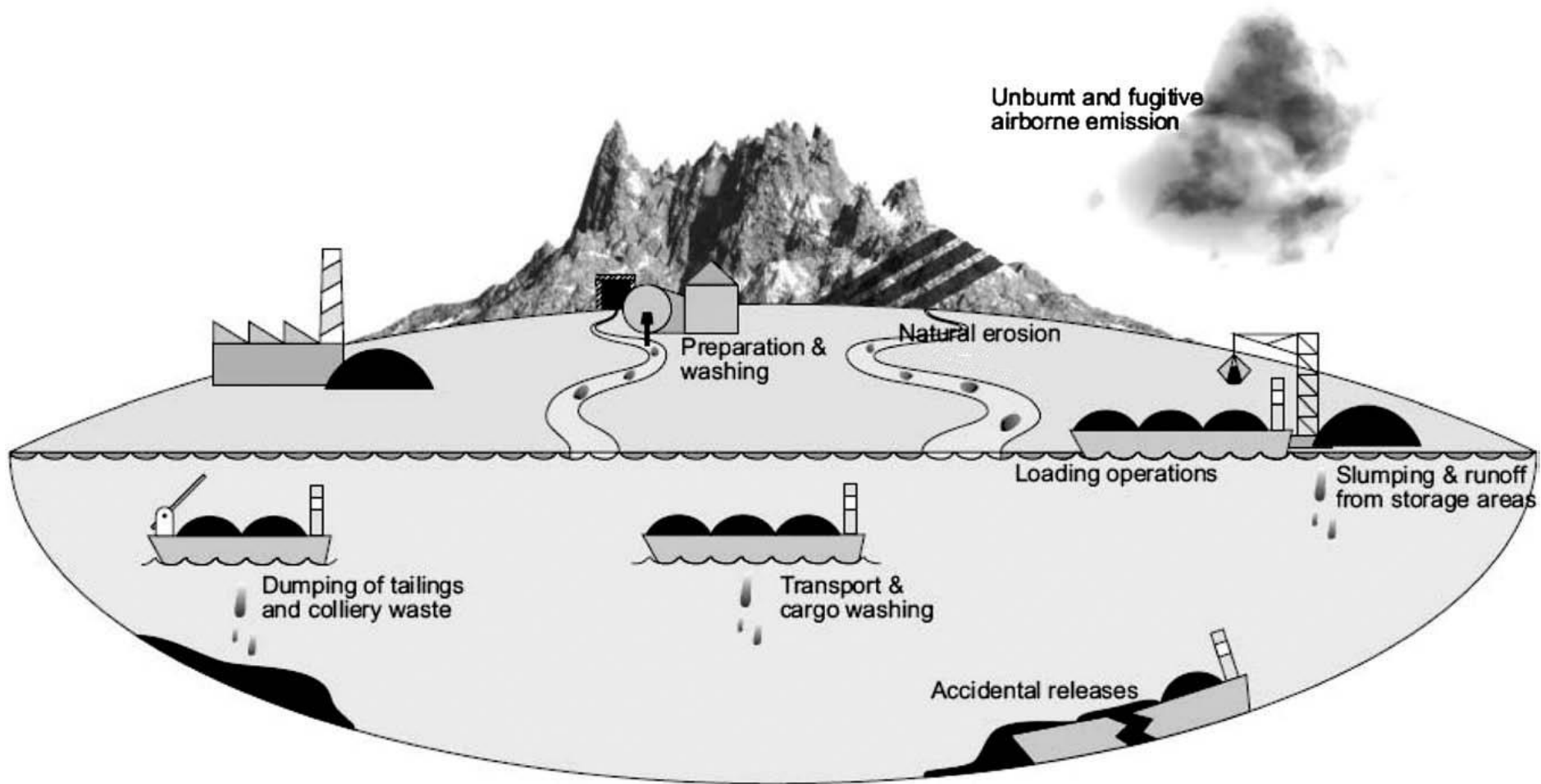
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# Outlines

1. Traditional analysis of pollutants
2. SPME What is it? How it works?
3. Traditional methods vs. innovative SPME
4. Application of SPME to leachate analysis of oil shale processing waste
5. Conclusions

# Emission sources of pollutants

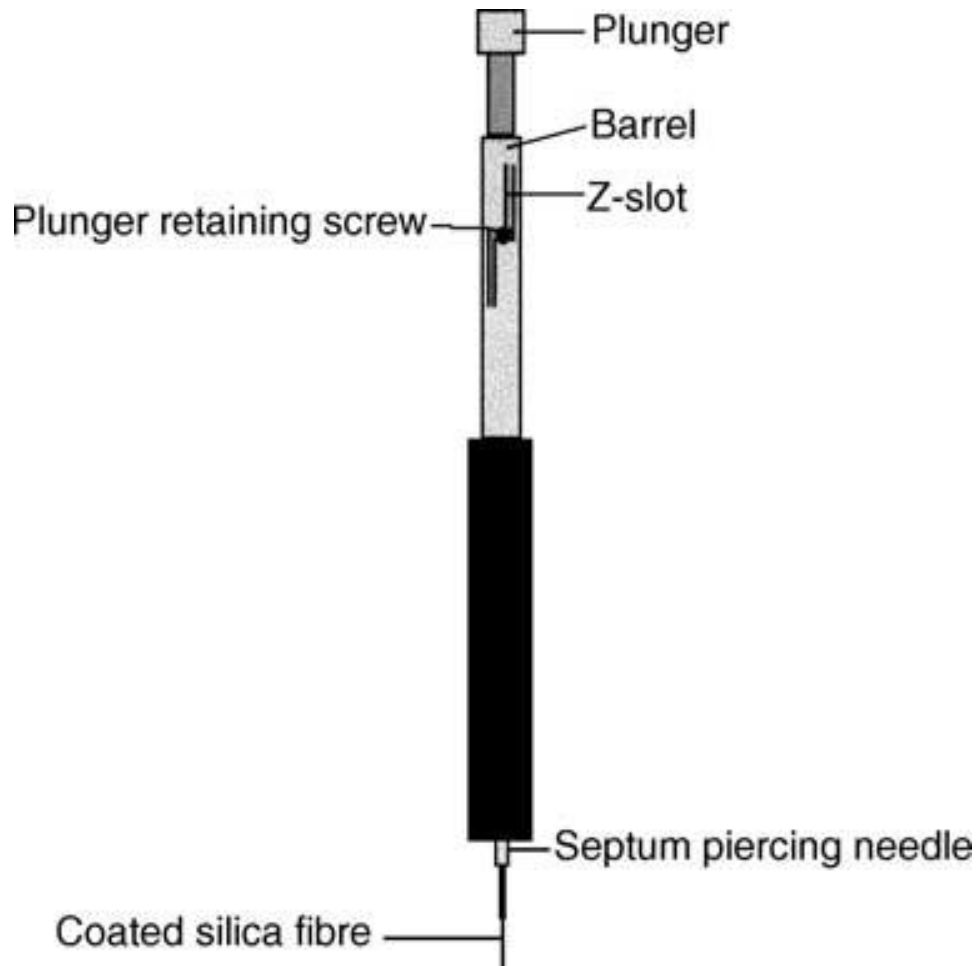


The analysis of organic contaminants in air, water and soil has become more and more important due to increasing environmental concerns.

The development of simple, efficient and inexpensive analytical methods are crucial for environmental monitoring.

# Solid phase microextraction (SPME)

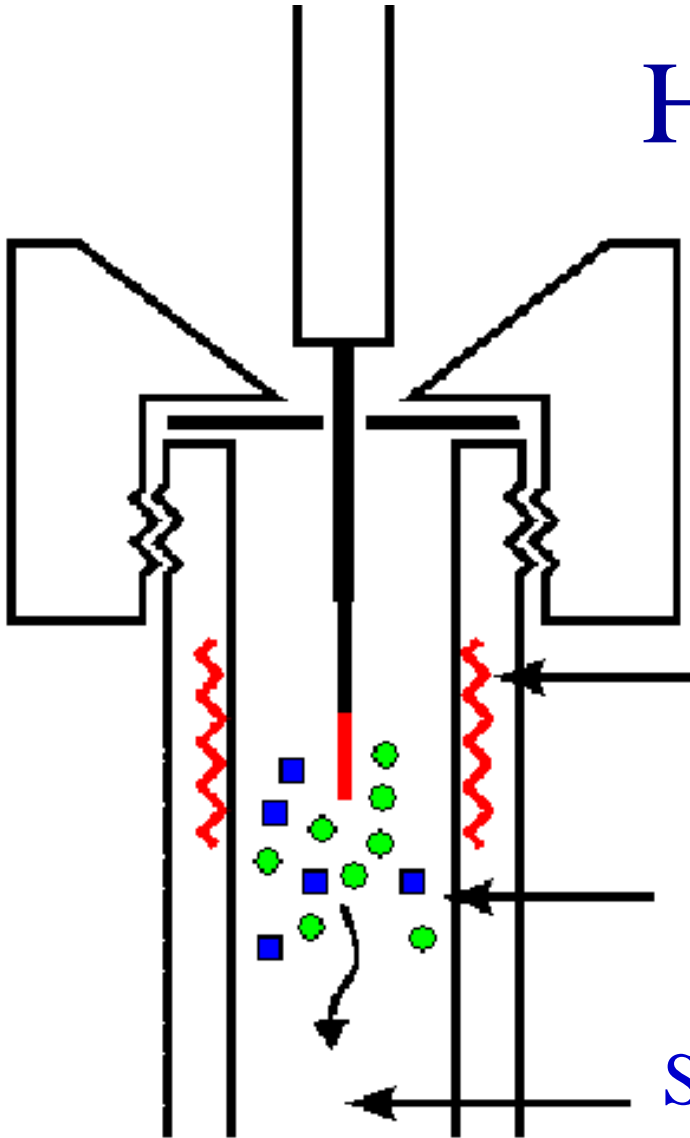
## What is it?



King et al., *Environmental Geochemistry and Health* **25**: 69–75, 2003.

# SPME

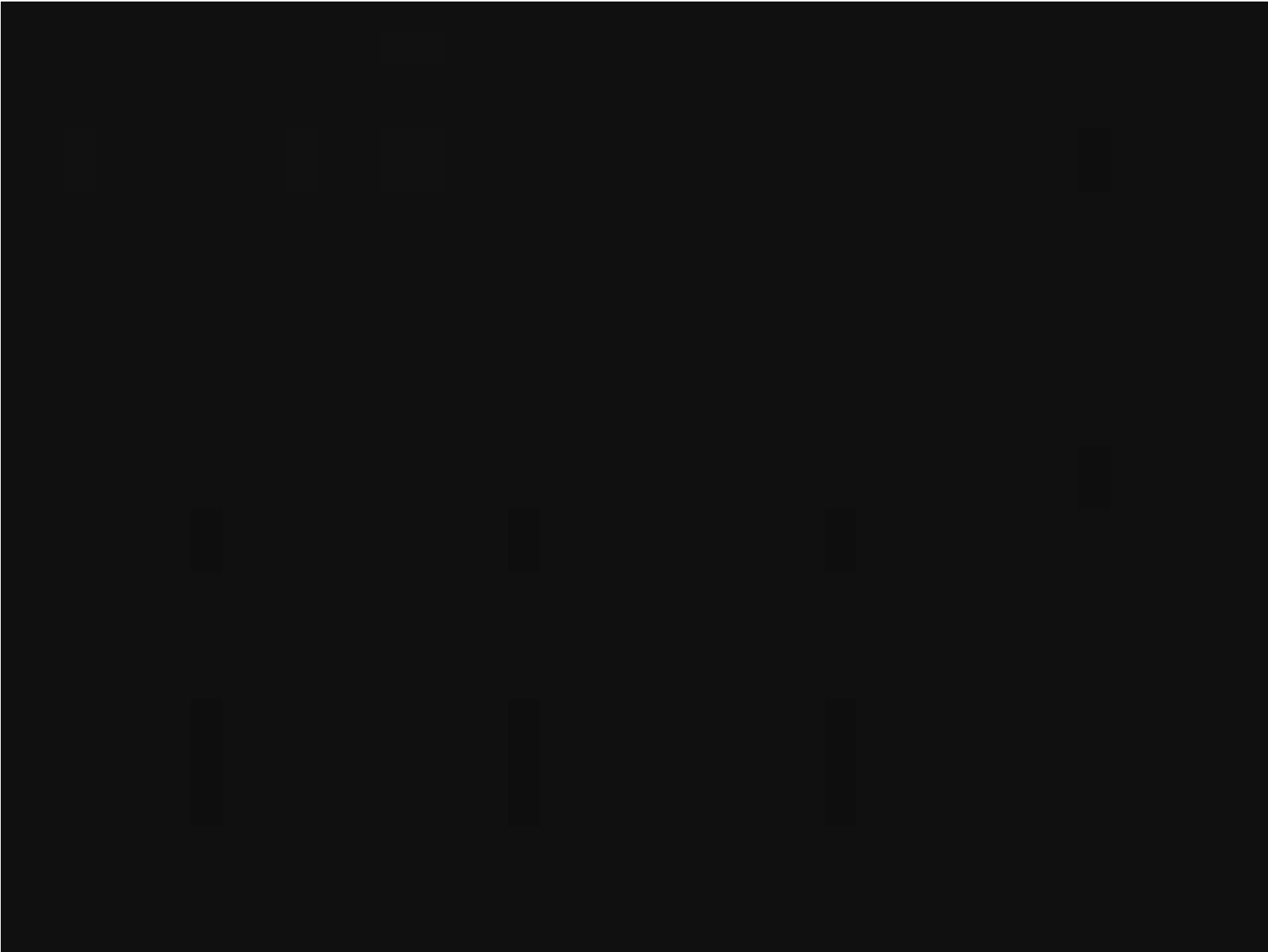
## How it works?



Desorption

*Polycyclic aromatic hydrocarbons (PAHs) or other analyte of interest*

Sample (oil shale wastewater, soil, sludge or other)



<http://www.sigmaaldrich.com/analytical-chromatography/video/spme-video.html>

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# Conventional methods vs. SPME (1)

Sampling

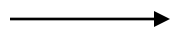
Extraction

Preconcentration

Chromatographic  
introduction  
technique

SPME is a  
combination of  
multistep  
traditional  
techniques

Time consuming



Fast (can be done in minutes)

Laborious

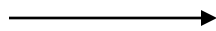


Simple

# Conventional approach vs. SPME (2)

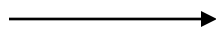
- ✓ High amount of solvents and other chemicals is needed.
- ✓ Most of solvents are toxic.
- ✓ Solvents selection influences on chromatogram.
- ✓ Solvent free technology.
- ✓ The same fiber can be used 50-100 times.
- ✓ Fiber can be directly transferred to GC injector.

Expensive



Low cost

Toxic



Non toxic

# Conventional approach vs. SPME (3)

- ✓ Removes analytes of interest from the sample.
- ✓ Can deteriorate the sample.
- ✓ Sample volume is big.
- ✓ Analyte removed by the fiber proportional to the concentration of the compound in the sample.
- ✓ Minimized disturbance of sample matrices.
- ✓ Sample volume is small.

Risk to the environment



Environmental-friendly

# Application of SPME on field studies



- ✓ On-site analysis
- ✓ Screening purposes

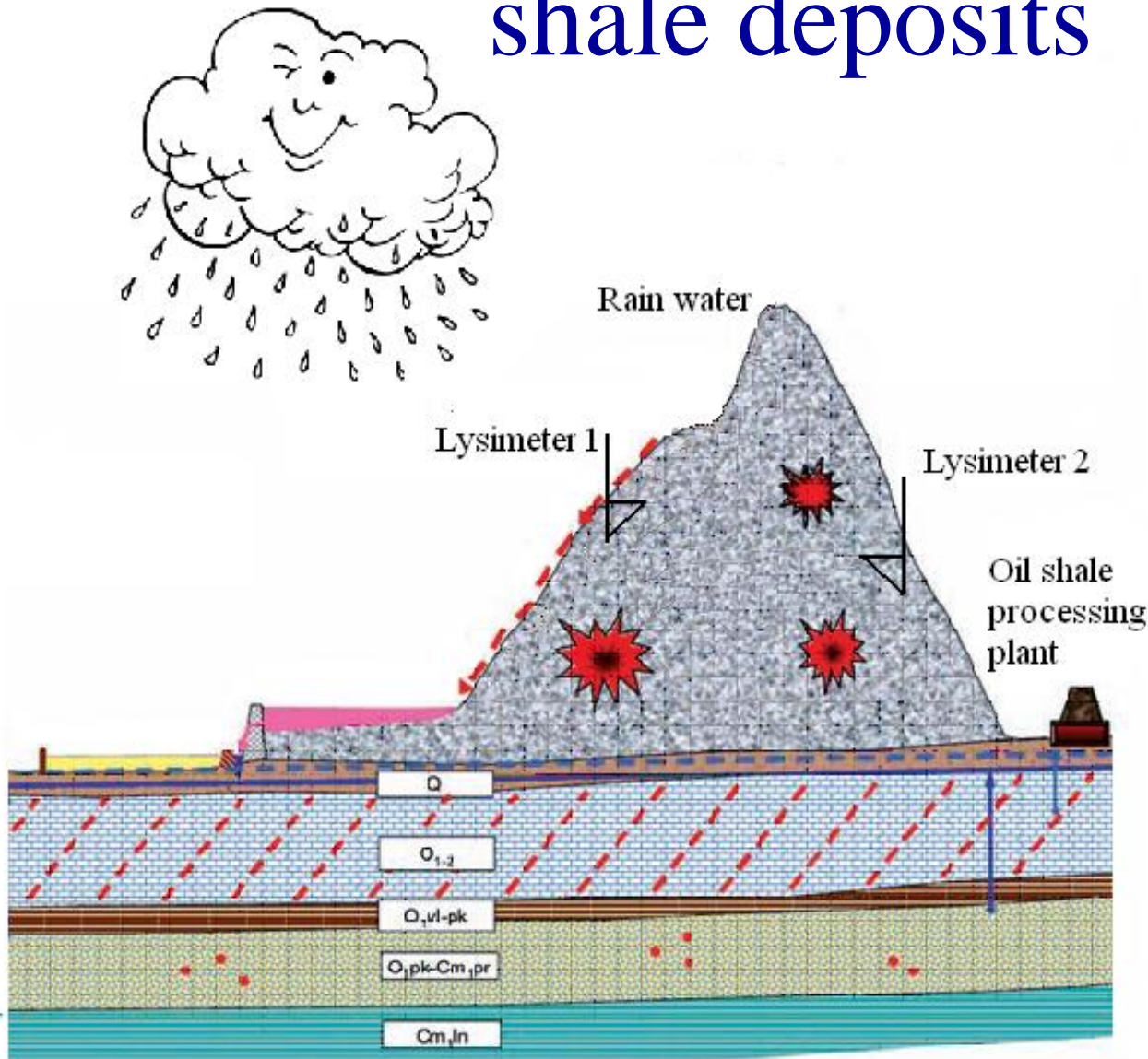
On-site sampling  
of river water using  
the thin film  
sampler

(Qin et al., Journal of chromatography A,  
1216 (2009) 6979-6985)

# Outlines

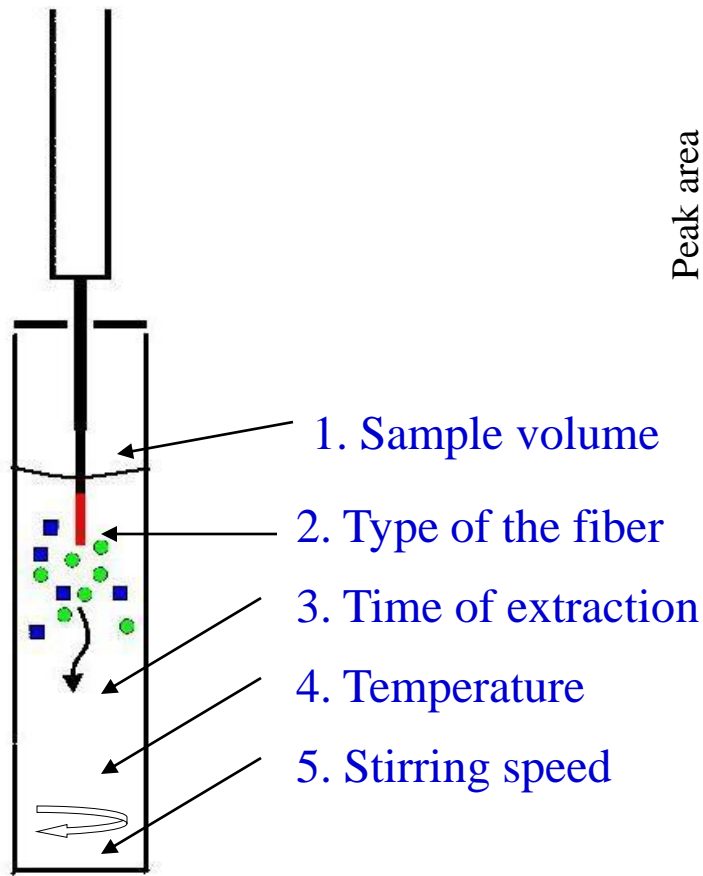
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# Schematic sampling sites on spent shale deposits

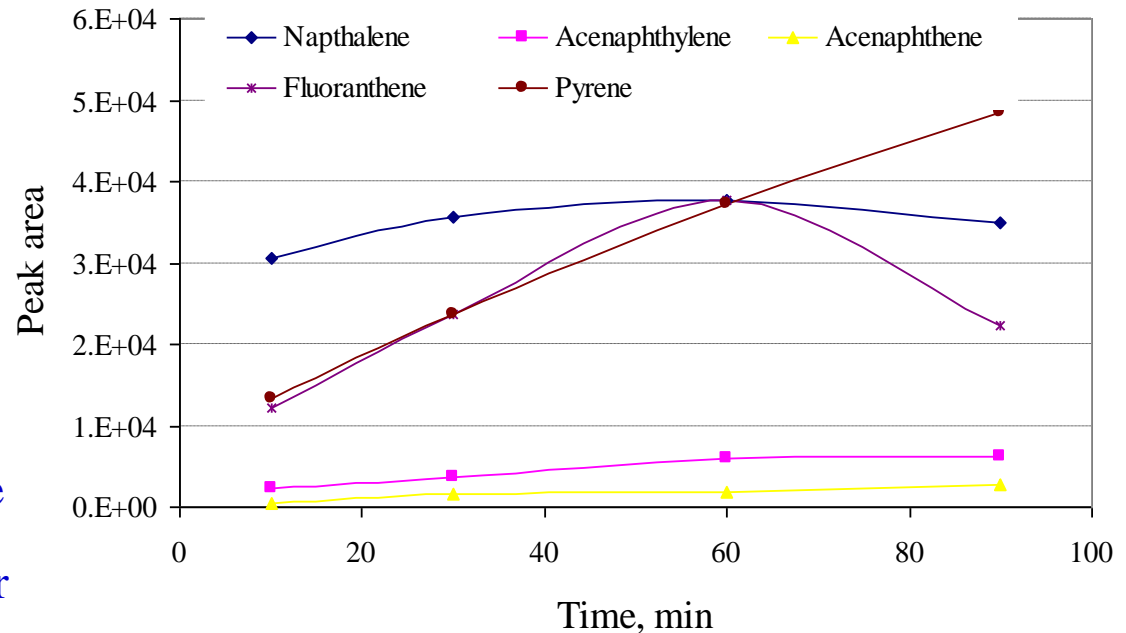


Adapted from "Eesti põhjavee kasutamine ja kaitse", 2004 L.Allikas

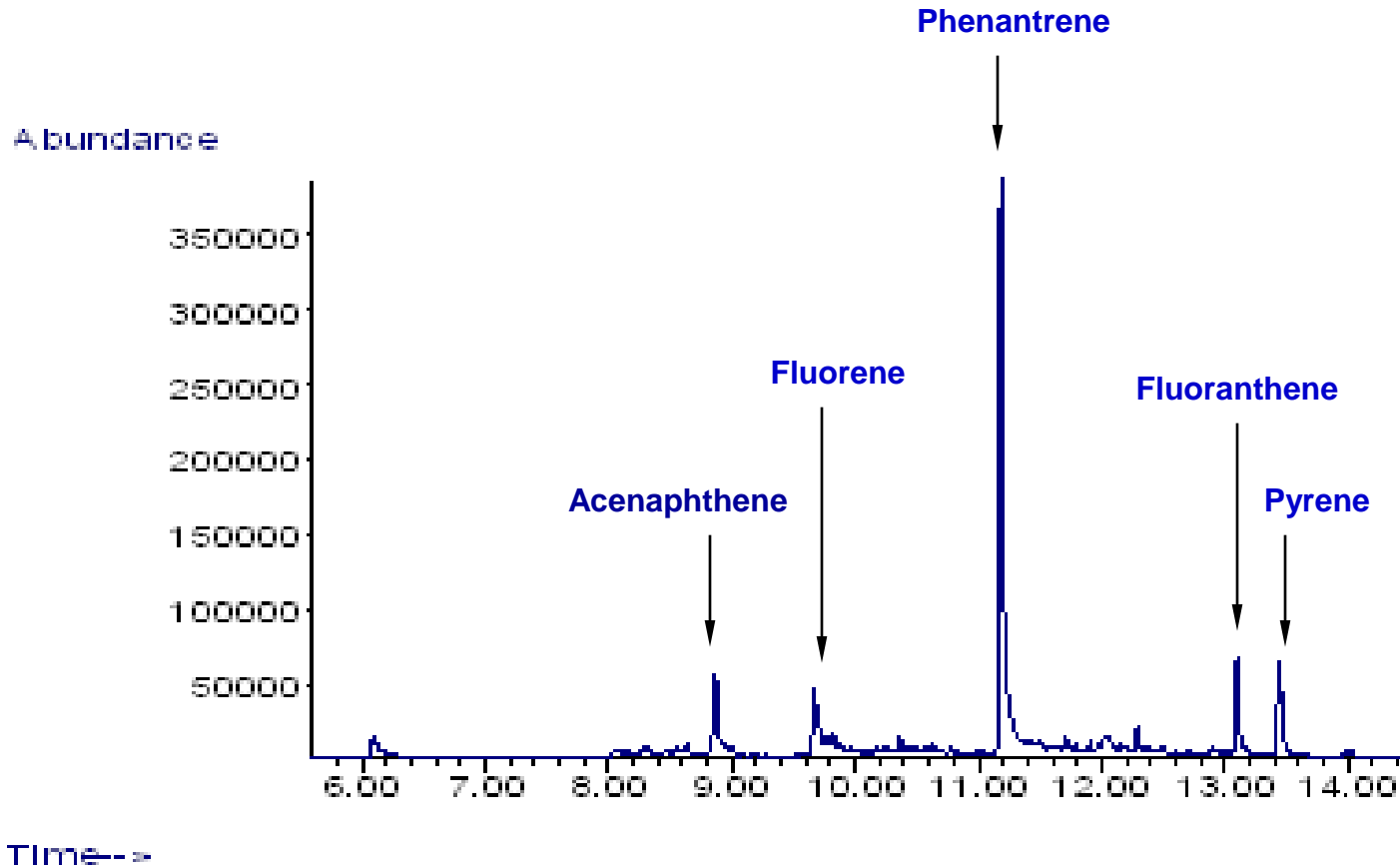
# Optimization of PAHs analysis method in oil shale waste leachate



Extraction time profile for the peak areas of PAHs



# Examples of PAHs analysis in oil shale waste leachate





# Conclusions

The proposed method can be recommended for leachate analysis of oil shale waste because it is:

- ✓ Simple
- ✓ Fast
- ✓ Environmental-friendly
- ✓ Sensitive
- ✓ Reliable
- ✓ Cheap

Thank you for your attention!

*Täna tähelepanu eest!*

Спасибо за внимание!



TARTU ÜLIKOOL  
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