Interspill 2015 Bioremediation Workshop

New approaches for improved use of bioremediation strategies

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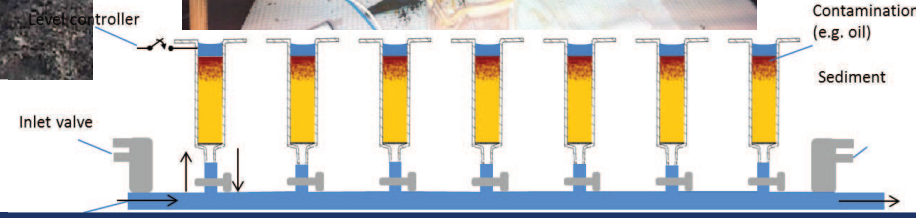
Bioremedediation of oil contaminated shoreline sediments



Factors affecting biodegradation/bioremediation

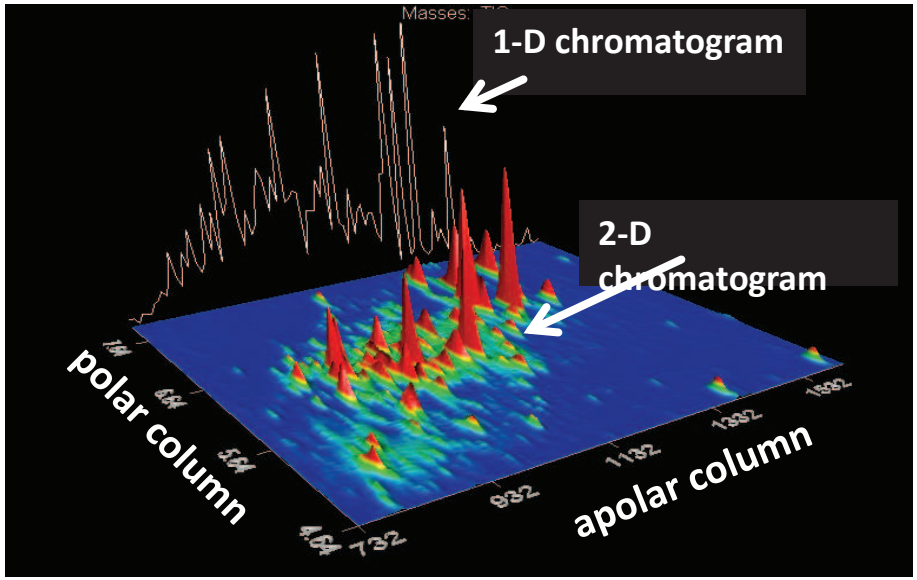
Bioremediation is heavily influenced by the nature of the contaminated environment and the interaction between microorganisms

- Microbes/consortia
- Environmental parameters; temperature, …..
- Dissolved oxygen/electron acceptors
- Nutrient limitation (N, P, Me, …)
- Pollutant accessability
- Pollutant biodegradability (composition/weathering)
- Pollutant concentration/film thickness
- Oil-water interface area
- Transport processes
- Toxicity (low_{Mw} alcanes, BTEX, monosubst. Aromatics)
- Inhibitors (H_2S etc), intermediates/products
- Other natural processes (washout, MFA)
- Others……

Limiting component/factor(s) will determine bioremediation strategy

Use of novel technologies for oil biodegradation studies

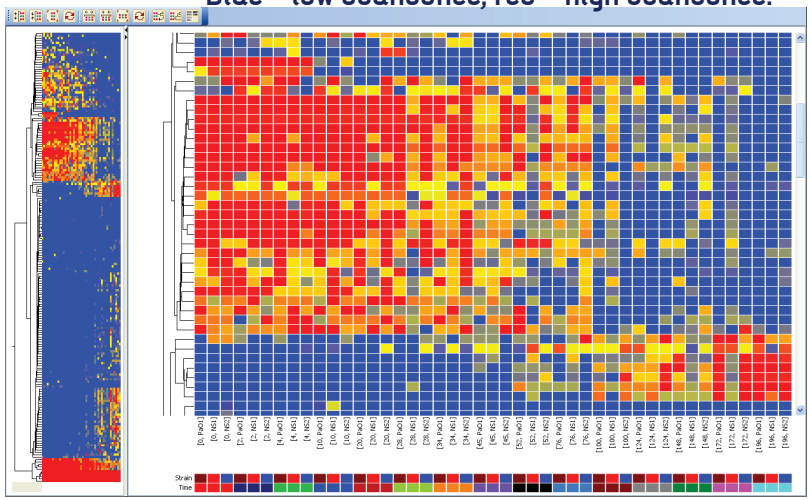
- Advances in methods for oil analyses
  - Improved sensitivity of GC-MS and LC-MS methods
  - Better resolution of complex mixtures (e.g. GCxGC-ToF-MS)
- Better characterization of microbial communities
  - Improved nucleic acid extraction methods for environmental samples
  - Pyrosequencing
  - Microarrays
- Better characterization of microbial processes
  - Transcriptomic, proteomic and metabolomic approaches ("*Petrolomics*")



GCxGC-ToF-MS 2-D Chromatogram of an aqueous soluble monoaromatic UCM (Steve Rowlands, University of Plymouth)

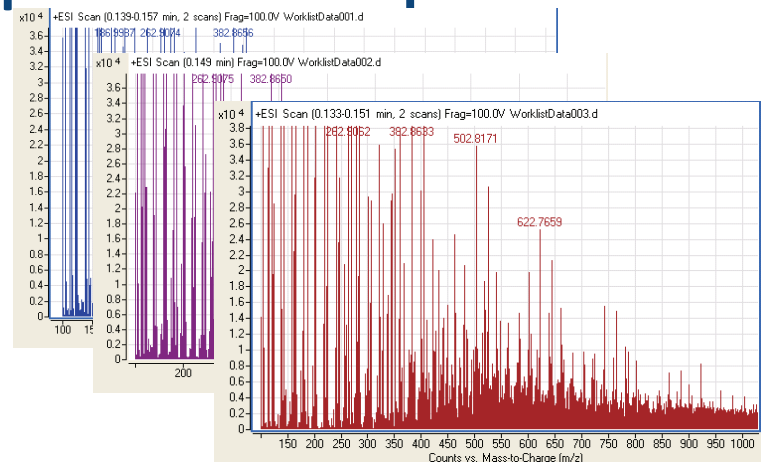
Metabolomic studies – elucidating complex metabolic patterns

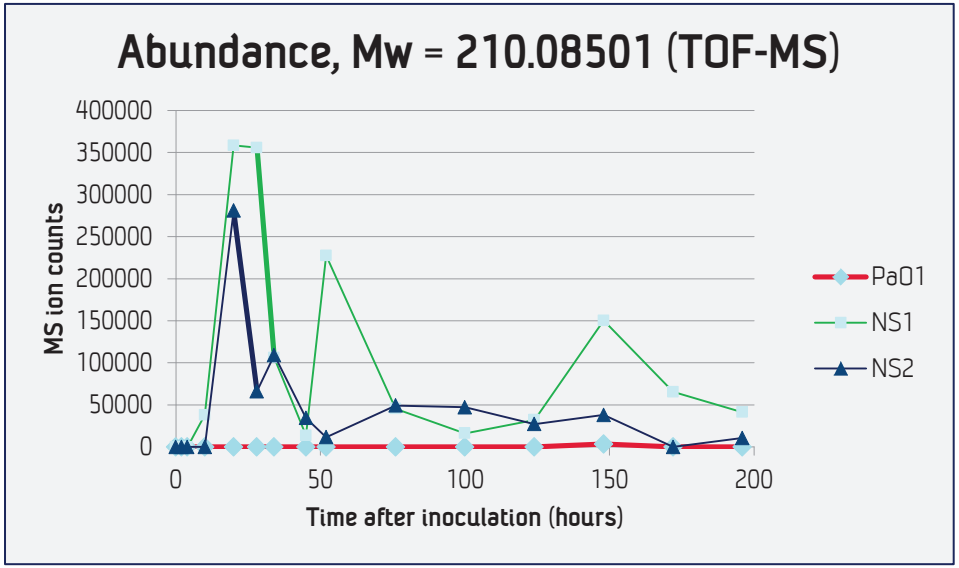
Blue = low abundance, red = high abundance.



Different masses (ToF-MS analyses)

Different environmental conditions

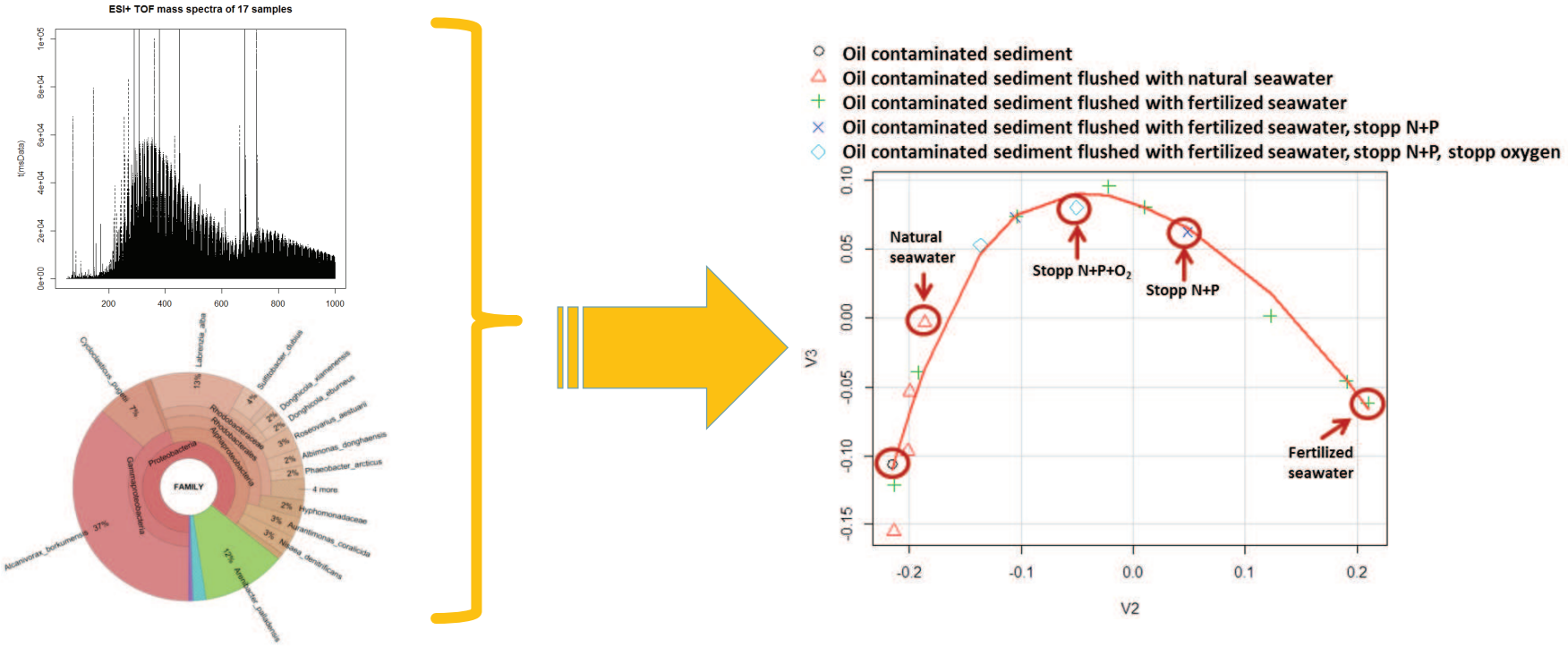




From a complex metabolic pattern can single masses be identfied with respect to microbial degradation under different environmental conditions

Multivariate statistic assessment of bioremediation processes

- High resolution chemical analysis and state-of-the art microbial analysis generate large amounts of data
- Multivariate data analysis methods can be used to visualize biodegradation processes.
- Bioremediation courses and trends can be predicted and optimized according to environmental conditions



Operationalisation – Bioremediation When Where How

Bioremediation is (normally) a secondary cleanup strategy (time!)

State-of-the-art microbiological and chemical analysis methods available for contamination characterisation/monitoring can better help to answer decision questions:

- When, is it suitable/necessary to use/initiate bioremediation actions?
- What kind of actions should be implemented – what are the limiting factors?
- How efficient is the bioremediation action?
- How can the bioremediation be optimized?
- How long will processes be efficient? Need the biomass to be further activated and if so, when?
- When should remediation actions be terminated – definition of termination criteria?

Technology for a better society