

SOCOTEC

THE POWER OF FORESIGHT

MMO Analysis of Marine Sediments

Dredging Liaison Group


TIM BARNES
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WHO ARE SOCOTEC

SOCOTEC is the UK's leading provider of testing, inspection and compliance services, with comprehensive solutions in the Infrastructure & Energy and Environment & Safety sectors. SOCOTEC has been conducting Marine Analysis for almost 20 years working closely with specialist marine science clients.



SOCOTEC IN NUMBERS



SOCOTEC offers over **200** testing, inspection and compliance services



SOCOTEC carries out **7 million** tests and inspections each year



SOCOTEC employs over **1,400** people



SOCOTEC services over **5,000** clients



SOCOTEC operates from over **30** sites nationwide

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MMO Analysis of Marine Sediments

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MMO ANALYSIS REQUIREMENTS

The Marine Management Organisation (MMO) is an executive non-departmental public body, sponsored by the Department for Environmental, Food & Rural Affairs. They license, regulate and plan marine activities in the seas around England so that they are carried out in a sustainable way.

Before applying for a licence, specific analysis requirements for chemical and physical determinands (something being tested for) and an associated sampling plan will need to be agreed by MMO

You must submit results of sediment sample analysis to the MMO along with a marine licence application where applicable. Results should be a single report. Laboratories must also provide chain of custody evidence in support of the analysis results to prove samples have been handled and stored correctly.

You must make sure that sediment analysis is performed by a competent laboratory. SOCOTEC hold MMO approval for a wide range of analysis techniques.



MMO QUALITY

MMO approval require a specific quality regime to be carried out

● SAMPLING

- > Frozen in glass containers
- > Containers acid cleaned and solvent-rinsed
- > Solvent-rinsed aluminium foil on caps

● PRESERVATION

- > <25°C throughout any stage of storage or transportation
- > Short-term storage (< 1 week) at 4°C
- > Long-term storage (up to 3 months) at -20°C

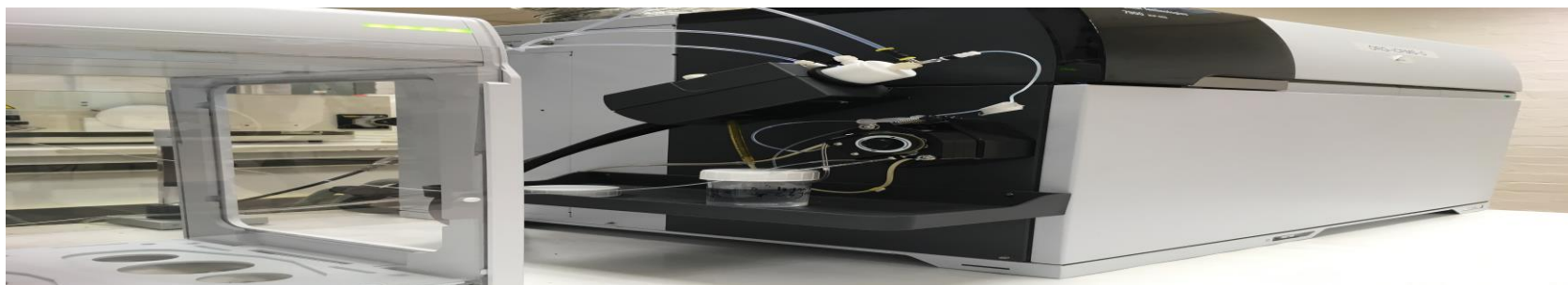
● ANALYSIS PROTOCOLS

- > Specified LODs & LOQs
- > On-going analytical accuracy/precision
 - Certified Reference Material (CRM) or In-house Reference Material (IHRM) analysed every batch of 10 samples
 - Extraction blanks analysed every batch of 10 samples
 - Controlled using Shewhart charts
 - Participate twice a year in QUASIMEME (Quality Assurance of Information for Marine Environmental Monitoring in Europe)



Inorganics (Trace metals)

- > Samples digested in aqua regia (mixture of nitric and hydrochloric acid)
- > Custom made extraction vessels are used to provide even heat distribution
- > Complex matrix can contain high levels of organics
- > Carried out on whole (non-sieved) sediment
- > Reported on dry weight basis
- > Multi-level instrument calibration and internal standards (Ge & Tb) employed
- > Analysis by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)
 - As, Cd, Cr, Cu, Pb, Hg, Ni, Zn



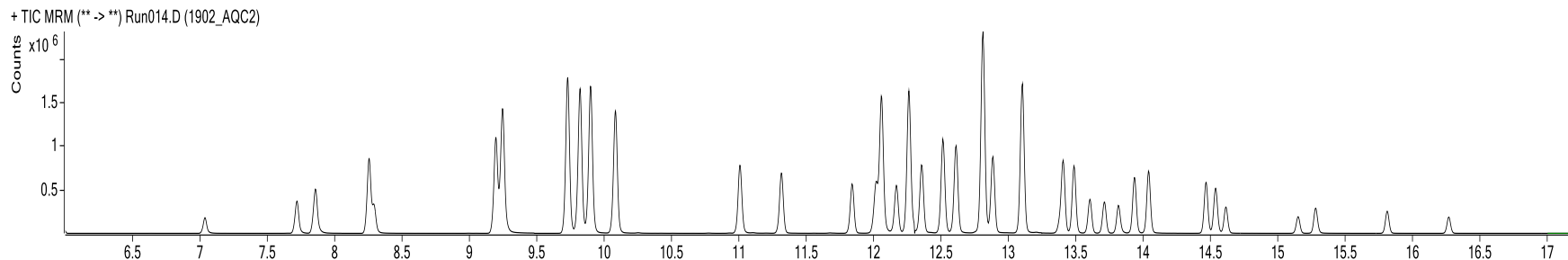
Organotins

- > Samples ultrasonically extracted in acidified Methanol and Toluene
- > Extracts derivatised with Sodium tetraethylborate (STEB)
- > STEB derivatising agent degrades quickly so must be used fresh
- > Carried out on whole (non-sieved) sediment
- > Reported on dry weight basis
- > Multi-level instrument calibration and internal standard (Tetrapentyltin) employed
- > Analysis by Gas Chromatography Mass Spectrometry (GC/MS)
 - Tributyltin & Dibutyltin
- > As tin can bind to surface of detector, regular cleaning required to maintain sensitivity



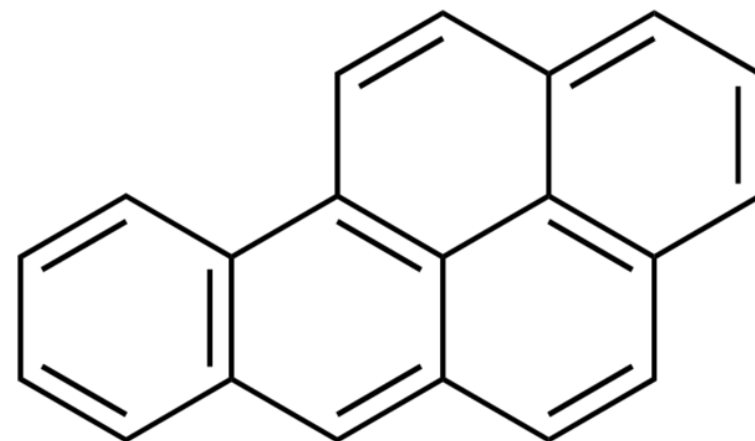
Polychlorinated Biphenyls (PCBs) & Organochlorine Pesticides (OCPs)

- Samples ultrasonically extracted in a mixture of Hexane and Acetone
- Extracts cleaned using copper and Florisil dSPE (dispersive solid phase extraction)
- Carried out on dried sediment sieved to less than 2mm fraction
- Multi-level instrument calibration and deuterated/¹³C labelled internal standards employed
- Analysis by Gas Chromatography Triple Quadrupole Mass Spectrometry (GC/MS/MS)
 - 25 PCB Congeners including the ICES 7
 - alpha-HCH, gamma-HCH, Dieldrin, HCB, p,p'-DDE, p,p'-DDT, p,p'-DDD
- GC/MS/MS is a highly selective and sensitive technique to achieve the sub ppb detection limits required
- Specific analytical column needs to be employed to give resolution of the complex mixture of PCBs



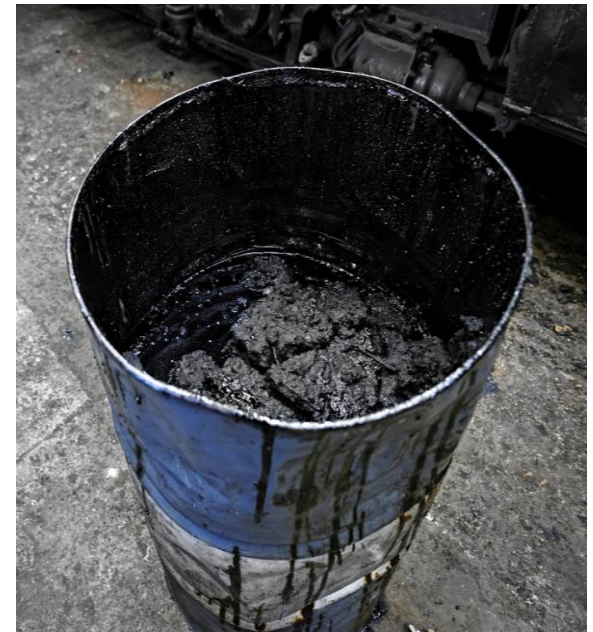
Polycyclic Aromatic Hydrocarbons (PAHs)

- > Samples ultrasonically extracted in a mixture of Dichloromethane and Methanol
- > Extracts cleaned using Silica SPE
- > Carried out on whole (non-sieved) sediment
- > Reported on dry weight basis
- > Some PAHs are light sensitive so protect from sunlight
- > Multi-level instrument calibration and deuterated labelled internal standards employed
- > Analysis by Gas Chromatography Mass Spectrometry (GC/MS)
 - EPA16 suite of PAHs plus C1-Naphthalenes, C1-Phenanthrenes, C2-Naphthalenes, C3-Naphthalenes, Benzo[e]pyrene, & Perylene
- > Specific analytical column needs to be employed to give resolution of the complex mixture of PAHs



Total Hydrocarbon Content (THC)

- Samples ultrasonically extracted in Dichloromethane
- Carried out on whole (non-sieved) sediment
- Reported on dry weight basis
- Multi-level instrument calibration employed
- Analysis by Ultra-violet Fluorescence Spectroscopy
- Calibration based on a standard crude oil
 - Method quantifies aromatics so matrix match the crude oil if possible as different crude oils will have different aromatic contents



SUMMARY

SOCOTEC has established a long standing reputation for technical expertise in marine sediment testing. The company's robust extraction and analytical procedures have been developed specifically for complex marine samples.

KEEPING AT THE CUTTING EDGE OF SCIENCE

SOCOTEC is supporting the Sullied Sediments Project in reducing chemicals in our waterways. The Sullied Sediment Project is a €4 million Europe-wide project, led by the University of Hull, to enable regulators and water managers to make better decisions with regard to sediment management, removal and disposal. Currently, managing authorities do not have the tools to assess sediments accurately and cannot, therefore, make confident decisions regarding the level, location or impact of pollutants.

As the UK's leading provider of testing, inspection and compliance services, with a wealth of experience in marine sediment analysis, SOCOTEC has been chosen by the 'Sullied Sediments' Partnership for a three year agreement to provide research into the analysis of sediments for metals, Dioxins, hydrocarbons and nutrients. As well as this, SOCOTEC will be providing consultancy on the methods for Watch List chemical analysis.



'Sullied Sediments' has been co-funded by the European Regional Development Fund through the Interreg VB North Sea Region Programme with a grant of 2.043.413 € with equivalent match funding from the partners involved. The project partnership includes public, private and third sector organisations based in the United Kingdom, Germany, Belgium and the Netherlands. The project will see work carried out at nine sites that have a previous history of sediment problems, in the North Sea Region's Elbe, Humber and Scheldt river catchments.

REGISTRATIONS AND ACCREDITATIONS



Supplier No: 058934



Supplier No:
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1015
1252
1157
0148
1089



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6123



GB 94/3455 ISO 9001:2008
GB15/93632 ISO 14001:2004
GB15/93733 BS OHSAS 18001:2007



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For more information about our services,
please contact us on:

E: salesuk@socotec.com

T: 0845 603 2112

W: www.socotec.co.uk