

Welcome to the March 2023 edition of LPD Lab Services newsletter.

LPD Lab Services are the experts in materials, chemicals, technical engineering and scientific problem solving for products and manufacturing processes across all sectors within Quality, Facilities, Manufacturing, Engineering, Development and Research.

LPD Lab Services develop innovative and practical analytical solutions as well as bespoke testing methods for in-process manufacturing, finished products and field failure as well as for the development of new products and materials. Staff pride themselves resolving some fascinating and complex technical problems from across diverse product ranges and sectors of industry.

The laboratory offers scientific and engineering solutions with timely response times and clear communications which are all core to the company's business model!

### This Edition at LPD Lab Services:

- Stress Corrosion Cracking of Metals and Environmental Stress Cracking of Plastics and Rubbers.
- Extractables and Leachables Analysis.
- New Ion Chromatography Instrumentation.
- Outsourcing Analytical Services and Method Development.

## Stress Corrosion Cracking of Metals and Environmental Stress Cracking of Plastics and Rubbers

Most metal corrosion, with the exception of pitting, is generally a slow process. However, it can combine with mechanical loading to produce a particularly aggressive form known as stress corrosion cracking or SCC. A tensile stress or residual stress frozen in and hence retained from component manufacture helps to open the crack tip and allow aggressive species like chloride or ammonia ions in and permits concentrated chemical attack.



The corrosion component of SCC drives the continuation of areas of crack growth even when the stress is lowered. Combining cyclic loading fatigue with corrosion is probably the most catastrophic form of attack affecting aluminum alloys in aircraft, in steel weld heat affected zones HAZ or in brass plumbing fittings for example.

The laboratory can investigate this form of corrosion and failure by techniques like SEM/EDX, Auger Electron Spectroscopy and ion chromatography together with optical microscopy, coupled with metallography and cross-sectional work.

Polymers and rubbers can suffer a similarly aggressive form of attack called Environmental Stress Cracking or ESC, where residual stress or mechanical load is combined with chemical attack such as solvent swelling giving rise to effects like cracking and crazing which can weaken disinfection practices in medical applications. Additionally some metal species can cause depolymerisation and materials disintegration for example. These issues have been evaluated by SEM/EDX, FTIR, GC-MS and trace element analysis by ICP-MS techniques. Chemical compatibility can be explored using test samples to prove the vulnerabilities in accelerated tests looking for similar or early stage failure symptoms in laboratory conditions.

## Extractables and Leachables Analysis

Analysis of extractables and leachables is important for chemicals and materials in their applications. Extractables are any compounds from materials or devices that can be forced to migrate under laboratory conditions mimicking what might happen in functional service situations. Leachables are extractable compounds that have migrated into the final product under normal conditions.

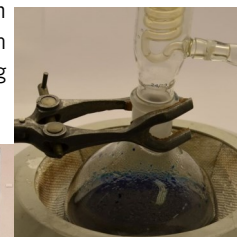
Knowledge of potential extractables from raw materials, products and processes can be essential to improving quality, assessing health risks and problem solving.

Extractables analysis uses aggressive testing conditions such as solvents, temperature and exposure time to force any potential extractables to migrate. The exact nature of the extractable test design will depend on the material / product being tested and its intended use with the

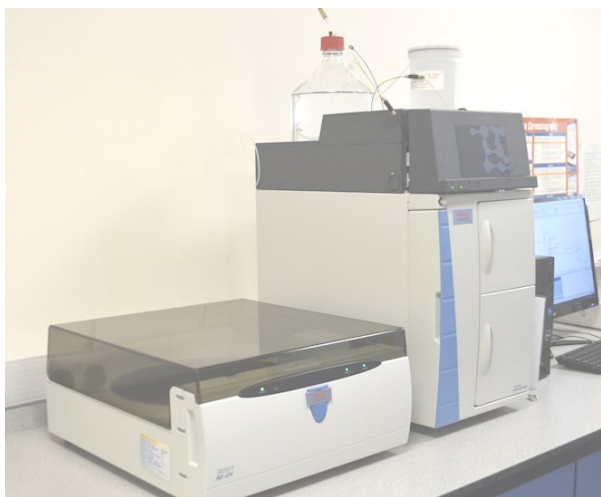
idea of creating exaggerated conditions to generate more extractables than would be seen under normal conditions without going so far as to cause breakdown of the material. This in effect generates a worst case scenario.

Pipetting and sampling once the extraction has been performed means the extract can then be analysed using a variety of techniques to characterise the extractables present looking for volatile, semi-volatile or non-volatile organic compounds and elemental analysis for inorganic compounds such as metals.

LPD Lab Services have a wide range of equipment and techniques that can be employed to analyse any extractables obtained from a sample. The exact nature of the type of testing needed will be largely dependent on the sample being submitted for testing but the lab endeavours to identify as many of the extractables as possible. Typical tests used would include GC-MS for semi-volatiles, Headspace GC-MS for volatiles, LC-MS and FTIR for non-volatiles and ICP-MS, AAS or IC for metals, ions and wider inorganic compounds.



## New Ion Chromatography Instrumentation

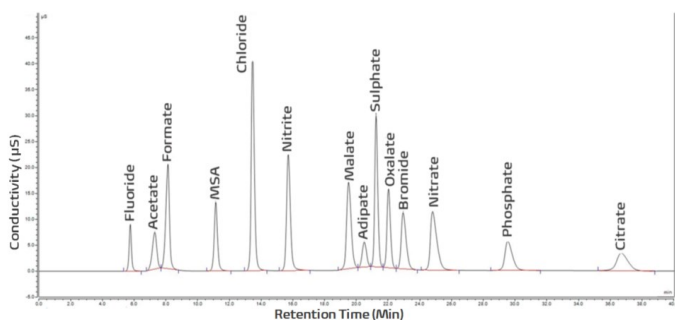


The laboratory has recently invested in a new Ion Chromatograph (IC) Instrument. A Thermo Scientific Dionex Integriion HPIC system was selected which provides the detection, flexibility and ease of operation to deliver a range of UKAS and non-UKAS accredited methods for both Anionic and Cationic ions, but this latest purchase has been designated by the laboratory for anion and weak organic acid (WOA) use as another IC instrument remains set up for quick and effective cation quantification.

The IC analysis methods available at LPD Lab Services allows the detection, identification and quantification of concentrations of major anions such as: Fluoride, Chloride, Bromide, Nitrate, Nitrite, Phosphate and Sulphate.

This technique can also be extended to detect, identify and measure numerous weak organic acids. IC can also be used for the following cations: Sodium, Potassium, Lithium, Calcium, Magnesium, Ammonia.

The laboratory has a UKAS accredited method to measure water soluble anions. However, the combination of IC standard methods and experienced staff with their method development skills permit the detection and quantification of known and unknown ionic species and contamination for a wide range of customers and industries. The wider IC technique also allows detection of rarer anions such as Chlorite, Chlorate, Bromate and Acetate.



Some examples of where ion identification and quantification has been used by the laboratory over the years include:

- Drinking, towns, demineralized, ground and rain waters as well as wastewater or effluents.
- Ionic contamination analysis of PCBs where ionic residues can lead to corrosion of components and hence premature board failures.
- Evaluating building facilities infrastructural failures in cooling and recirculating water for chiller or heating applications.
- Analysis of soluble anions and cations on environmental monitoring filters or contamination building up or blocking in-line membrane filters.
- Analysis of soluble / leachable anions and cations from solid samples such as medical devices and polymers.
- Trace exposure to salt water or sea spray (chloride) promoting corrosion on steel, under or on paint coatings, on aluminium or on various metal surfaces which can lead to serious quality concerns in aerospace,
- Automotive and nuclear industries.
- Check for aggressive ions that might promote corrosion on material surfaces or leached from the bulk like phenolic foam pipe insulation and WOA that promote ants nest corrosion of copper.
- Determination of anions and cations in bulk materials or from washed or rinsed surfaces.
- Identification of WOA generated from Microbiologically Induced Corrosion MIC in antifreeze / glycol treated recirculated water systems.
- Degradation and consumption of polymer stabilisers like aryl phosphates and fire retardants signifying near end of service life.

## Outsourcing Analytical Services and Method Development

LPD Lab Services business model allows clients to outsource some or all of their Analytical / Development / R&D function. The lab's analytical equipment and expert staff allows the offering of high quality and technical insight into developing both the chemical, physical and material aspects of the product and even selection and purchase of capital analytical equipment chosen for their specific intended use. LPD have experience of R&D in problem solving, method development, and process optimisation and is in a unique position to offer a full spectrum of outsourced lab services to industries across the world.

Our scientists immerse themselves in the technical needs of the project, communicate regularly and become an extension of the client's scientific function in developing new IP and technical problem solving for the client's exclusive use.

Whether a customer is facing a lack of expert personnel, resources, or specialised equipment, the laboratory's team can provide a customised solution that saves client's time and can eliminate the cost of unnecessary investment or training. Alternatively, LPD Lab Services can also offer method development and roll out training to the client's own staff.

To understand more about the laboratory's outsourced and other expanding technical services as well as analytical testing capability please visit our website or call 01254 676074 to discuss the problem/ technique. Alternatively, arrange to meet the team and see the laboratory located in Blackburn, Lancashire.