

IP501 Metal content by ICP-OES in Residual Fuel Oils



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What Is ICP-OES

The ICP-OES is Inductively Coupled Plasma - Optical Emission Spectrometry, A sample is introduced by a fine aerosol spray into an Argon Plasma, burning at approx. 7000°C; the light emitted is measured by an Optical Spectrometer to determine the various wavelengths elements in the sample. At Stewart Inter Sea we have the capability to analyse a suite of twenty-one elements in under sixty seconds for Aqueous phase.



Why Do We Test

Determination of elements is essential for determining how to treat crude oils during refining, monitoring wear and tear in working fluids, controlling emission levels in road fuels, or identifying potentially hazardous contamination, such as used-lubricating oils in Marine Bunker Fuels.



How Does It Work

For IP501 the Residual Fuel Oil sample is first processed through the following four preparation steps:



Weighing – the sample is mixed well before weighing, providing a homogenous sample, of known quantity, so each element can be accurately calculated after analysis.



Ashing – the sample is ignited by heating over a Bunsen burner to remove all organic compounds, this sample is then placed into a muffle furnace at 525°C to further burn the carbon residue to a dry ash.





Fusion - The residue ash is fused with a dilithium tetraborate, lithium fluoride (flux) by placing in the muffle furnace, followed by a mixture of tartaric acid and hydrochloric acid to dissolve the fusion, which is then made up to 100ml with distilled water.



Analysis - The aqueous sample solution is then aspirated into the plasma of the ICP-OES, exciting the elements and the measured emission radiation is compared to a calibration curve constructed from standard calibration solutions.

The results are reported as parts per million (equivalent to 1 milligram per kilogram), although detection limits of ppb (parts per billion) is possible by alternative test methods.



Potential Issues and Solutions:

- Calibration and Sample Solution Mismatch: This results in non-quantifiable results, requiring the technician to prepare new standards to ensure proper matrix matching.
- Blockages: Check and change tubing, and inspect the nebulizer for blockages, which can lead to low sample quantity through the nebuliser, or cause and an unstable plasma, corrected through cleaning all parts of the ICP, preparing a fresh sample and repeating.
- Correct equipment operation: to ensure the plasma chamber is maintained at a workable temperature; otherwise, the plasma will go out and won't light.

Our team is proficiently trained and well-equipped to handle these potential pitfalls, ensuring the integrity and accuracy of the analysis, plus by maintaining rigorous standards and adapting to challenges, we ensure precise and reliable sample analysis.





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