



Acid Volatile Sulfur Analysis

The presence of Acid Volatile Sulfur (AVS) in acid sulfate soils and/or sediments has important ramifications for both Environmental and Acid Sulfate Soil Management. ALS has extensive experience in the determination of Chromium Reducible Sulfur and has recently achieved NATA accreditation for the analysis of Acid Volatile Sulfur.

Background on AVS

Acid Sulfate Soils (ASS) and sediments can contain very reactive sulfur species broadly classed as Acid Volatile Sulfur (AVS). These species are often in the form of iron monosulfides (FeS) and are generally associated with drainage channels, lake floors and within scalded acid sulfate soil sites. Minerals containing AVS include greigite, mackinawite and iron sulphide, all of which are easily converted to form pyrite (FeS₂) and ultimately, sulfuric acid (H₂SO₄). For this reason, assessment of these sulfur species is an important step in ASS management.

New AVS Analytical Service offered at ALS

In addition to the Chromium and SPOCAS Suites already available, ALS is now able to offer a fully NATA accredited AVS analytical service for the determination of AVS in soils and sediments to assist in the evaluation and management of Acid Sulfate Soils.

AVS Analytical Procedure

A wet sample of acid sulfate soil or sediment is used for the analysis due to the highly reactive nature of the samples. Hydrogen sulfide (H₂S) is liberated by the decomposition of reactive sulfur compounds via cold Hydrochloric acid (HCl) addition. The released sulfur is considered acid volatile sulfur. The reaction is contained in a purged, airtight nitrogen environment. The liberated H₂S is precipitated as a metal sulfide in a trapping solution which is then quantified by iodometric titration. A limit of reporting of 0.001 % S_{AV} is achieved.

The method followed by ALS is based on ASSMAC Laboratory Method Guidelines, August, 1998.



*Right solutions....
....Right partner*

AVS Interference Corrections

Only 75% of AVS is recovered using HCl. The remaining 25% is converted to elemental sulfur, formed by the oxidation of sulfide by Fe^{3+} which is liberated from the dissolution of iron oxides and greigite (Morse & Cornwell, 1987). This elemental sulfur is not converted to H_2S and therefore, is unable to be liberated and quantified. $S_{\text{AV}}\%$ reported by ALS is therefore corrected for Fe^{3+} Interference by applying a correction factor of 1.33 to the measured result.



Comparison of AVS vs Chromium Reducible Sulfur (CRS)

Monosulfidic compounds making up AVS are much more reactive than the disulfide compounds containing Chromium Reducible Sulfur and therefore, different handling procedures are required for the two methods. Samples for AVS analysis must be analysed without drying due to their highly reactive nature and are handled under Nitrogen in the laboratory to minimise oxidation of the samples. Samples for CRS are less reactive, but still need to be kept frozen and handled quickly to minimise oxidation. CRS analysis is best conducted on a dried and pulverised sample, in accordance with Australian Standards. The digestion procedures for the two methods differ slightly – AVS uses cold Hydrochloric Acid only as a reducing agent while CRS uses a much stronger reducing agent, chromous chloride, in addition to hot Hydrochloric acid to reduce pyrite and elemental sulfur. Both methods quantify Sulfur via the iodometric titration of H_2S . If a sample contains both AVS and CRS, only performing both tests will provide a full sulfur account.

Sampling, Sample Storage and Holding Times

AVS samples require special sampling and storage precautions to ensure the preservation of the highly reactive AVS. Ideally, field freezing of samples is recommended (Bush and Sullivan 1997). Oven drying procedures recommended for pyrite preservation (Ahern *et al.* 1996) are avoided as AVS minerals are oxidised (Bush and Sullivan 1997). Samples are to be kept frozen until analysis, to avoid oxidation of sulfides. The frozen samples are then thawed in a nitrogen atmosphere in the laboratory and analysed for AVS using the methods described above. Provided the samples are frozen immediately upon sampling and remain frozen until analysis, the holding time is indefinite.

References

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