



Application Note AN-T-032

Sulfide and hydrogen sulfide in water

Inexpensive determination by potentiometric titration

Sulfides are a commonly found class of minerals. Inorganic sulfides are used in the extraction of metals such as copper, iron, lead, zinc, mercury, and the metalloid arsenic due to their high abundance in sulfide mineral ore. The sulfides are separated from the metals and accumulate in the wastewater effluent. They are malodorous and cause corrosion problems in wastewater treatment facilities (especially concerning concrete and iron). In acidic water, sulfides react to form hydrogen sulfides, which

are extremely toxic even at low levels.

In addition, both sulfides and hydrogen sulfides are naturally present in thermal springs and could poison the bathers through evaporation. Therefore, it is important to monitor the amount of sulfides and hydrogen sulfides in the water.

This application note describes the trace level determination of sulfides and hydrogen sulfides in water in by potentiometric titration.

SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on spiked groundwater samples. The water is spiked with sodium sulfide.

EXPERIMENTAL

This analysis is carried out on an OMNIS Advanced Titrator equipped with an Ag Titrode with an Ag_2S coating. The Ag_2S coating lowers the detection limit and ensures a fast response.

Before the titration, the sample is purged with nitrogen gas in order to remove any remaining oxygen. The samples are then titrated with silver nitrate until after the equivalence point.

Immediately after the sample is bottled, it is preserved with sodium hydroxide, to prevent the sulfides from forming volatile hydrogen sulfides.



Figure 1. OMNIS Advanced Titrator equipped with an Ag Titrode with Ag_2S coating for the determination of sulfides and hydrogen sulfides in water samples.

RESULTS

Reproducible results are obtained in spite of the low concentration of sulfide in the sample and low titrant concentration. For the tested groundwater, a

hydrogen sulfide content of 0.31 mg/L ($n = 3$, $\text{SD}(\text{abs}) = 0.01$ mg/L, $\text{SD}(\text{rel}) = 1.91\%$) is obtained.

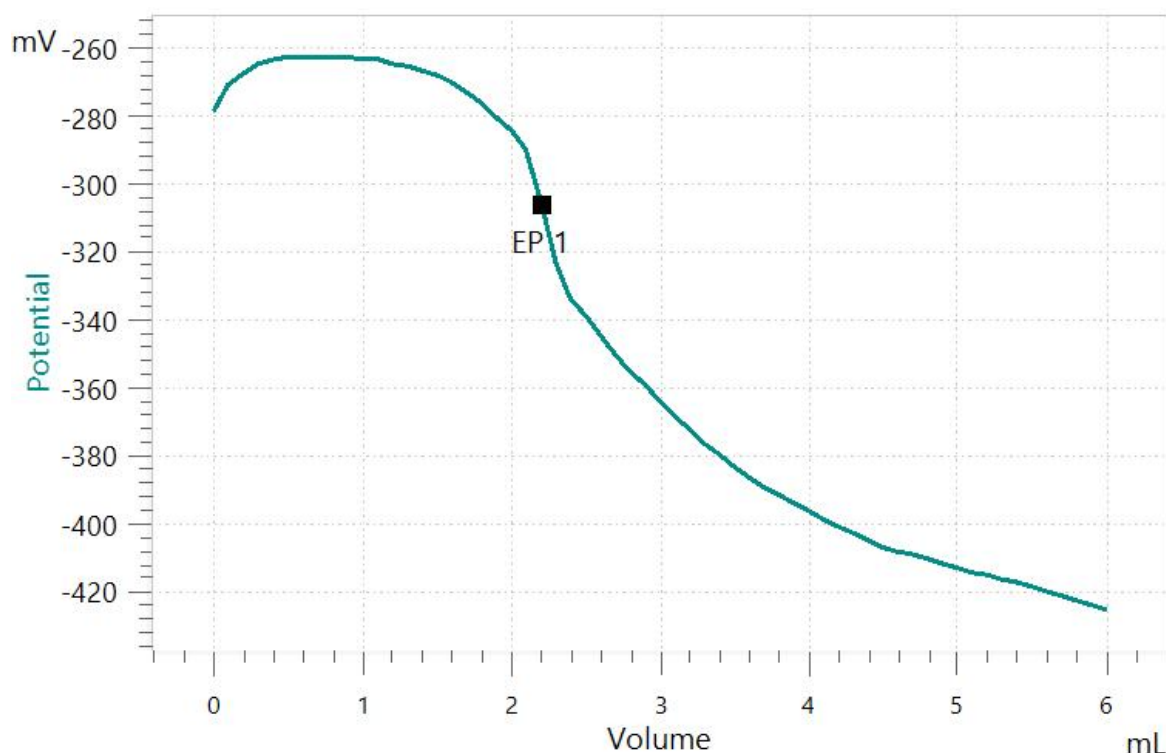


Figure 2. Exemplary titration curve of the hydrogen sulfides determination.

CONCLUSION

Titration is an inexpensive method to determine sulfides and hydrogen sulfides in water. The method can measure a hydrogen sulfide content as low as 0.31 mg/L. To measure higher hydrogen sulfide levels, the concentration of the titrant can be increased. Therefore, the samples do not need to be diluted, which could falsify the results. This makes titration a

versatile method covering a large concentration range in comparison to other methods such as photometry. Using an Ag Titrode with Ag_2S coating ensures a fast response time and a low detection limit. This electrode is additionally maintenance-free using a pH glass membrane as reference electrode. It can be simply stored in distilled water.

Internal reference: AW TI CH1-1300-032020

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CONFIGURATION



OMNIS Advanced Titrator with magnetic stirrer

Innovative, modular potentiometric OMNIS Titrator for stand-alone operation or as the core of an OMNIS titration system for endpoint titration and equivalence point titration (monotonic/dynamic). Thanks to 3S Liquid Adapter technology, handling chemicals is more secure than ever before. The titrator can be freely configured with measuring modules and cylinder units and can have a rod stirrer added as needed. If required, the OMNIS Advanced Titrator can be equipped for parallel titration via a corresponding software function license.

- Control via PC or local network
- Connection option for up to four additional titration or dosing modules for additional applications or auxiliary solutions
- Connection option for one rod stirrer
- Various cylinder sizes available: 5, 10, 20 or 50 mL
- Liquid Adapter with 3S technology: Secure handling of chemicals, automatic transfer of the original reagent data from the manufacturer

Measuring modes and software options:

- Endpoint titration: "Basic" function license
- Endpoint and equivalence point titration (monotonic/dynamic): "Advanced" function license
- Endpoint and equivalence point titration (monotonic/dynamic) with parallel titration: "Professional" function license



dAg Titrode with Ag₂S-coating

Digital, combined silver ring electrode for OMNIS with a pH glass membrane as reference electrode. The silver ring is coated with sulfide (Ag₂S) to increase the sensitivity and result in a better limit of determination.

The maintenance-free electrode is suitable for precipitation titration with a constant pH value (titrant: silver nitrate), e.g.

- Chloride, Bromide, Iodide
- Sulfide
- Dihydrogen sulfide
- Mercaptane
- Cyanide

This electrode is stored in deionized water.

dTodes can only be used with OMNIS titrators and titration modules with digital measuring interface.