



## Application Note AN-T-032

# Sulfide and hydrogen sulfide in water

## Accurate and inexpensive determination of $H_2S$ in water by potentiometric titration

Sulfides are sulfur compounds and are a common class of minerals. Inorganic sulfides are abundant when extracting 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 extracted materials and accumulate in the effluent where they affect water quality. They are malodorous (rotten egg smell) and are corrosive to sewage and water treatment plants (especially concerning concrete and iron).

In acidic water, sulfides react to form hydrogen sulfides, like  $H_2S$  gas, which are extremely toxic even

at low levels. In addition, both sulfides and hydrogen sulfides occur naturally in thermal springs and could poison visitors through evaporation. Therefore, it is important to monitor the amount of sulfides and hydrogen sulfides ( $H_2S$ ) in wastewater treatment facilities or municipal water supplies in general.

This Application Note presents a trace level hydrogen sulfide analysis method in water by potentiometric titration. Specifically, the determination of  $H_2S$  in water by titration is done with silver nitrate using an Ag Titrode with  $Ag_2S$  coating on an OMNIS system.

## SAMPLE AND SAMPLE PREPARATION

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

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

## EXPERIMENTAL

The determinations are carried out on an OMNIS Advanced Titrator equipped with an Ag Titrode with an  $\text{Ag}_2\text{S}$  coating (Figure 1). The  $\text{Ag}_2\text{S}$  coating lowers the detection limit and ensures a fast response. Before the sulfide titration, the sample is purged with nitrogen gas in order to remove any remaining oxygen. The samples are then titrated with standardized silver nitrate until after the equivalence point. An exemplary titration curve of spiked groundwater is given in Figure 2.



**Figure 1.** OMNIS Advanced Titrator equipped with an Ag Titrode with silver sulfide coating.

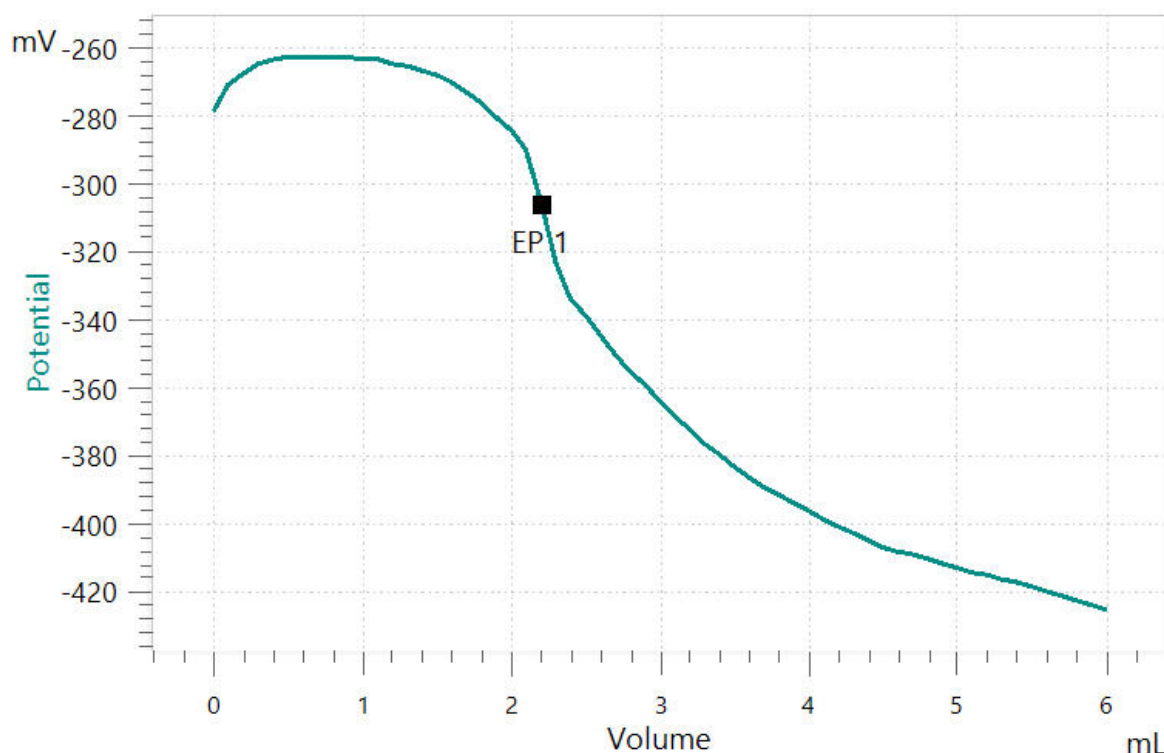
## RESULTS

This method offers very accurate and reproducible results despite the low concentration of sulfide in the

sample and low titrant concentration, as displayed in Table 1.

**Table 1.** Results for the  $\text{H}_2\text{S}$  concentration measured by potentiometric titration of a water sample ( $n = 3$ ).

| Sample ( $n = 3$ ) | $\text{H}_2\text{S}$ value (mg/L) |
|--------------------|-----------------------------------|
| Mean value         | 0.31                              |
| SD(abs)            | 0.01                              |
| SD(rel) in %       | 1.9                               |



**Figure 1.** Exemplary titration curve of the potentiometric determination of hydrogen sulfide in a groundwater sample.

## CONCLUSION

Titration is a fast, precise, and inexpensive hydrogen sulfide in water test method. It can accurately measure the hydrogen sulfide content down to as low as 0.31 mg/L. To measure higher hydrogen sulfide levels, the concentration of the titrant can be increased. Therefore, samples with high concentrations do not need to be diluted, which could falsify the results. This makes titration a versatile

method for covering a large concentration range, in comparison to other methods such as photometry. Using an Ag Titrode with  $\text{Ag}_2\text{S}$  coating ensures a fast response time and a low detection limit. This electrode is additionally maintenance-free and uses a pH glass membrane as reference electrode. It can be simply stored in distilled water and is perfectly usable for the hydrogen sulfide in water analysis.

Internal reference: AW TI CH1-1300-032020

## CONTACT

Metrohm Portugal  
R. Frei Luis de Granada 14G  
1500-680 Lisboa

[vendas@metrohm.pt](mailto:vendas@metrohm.pt)