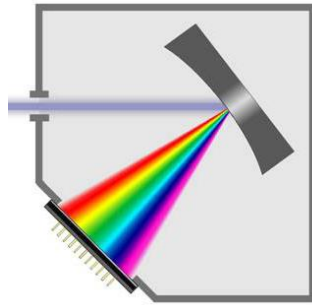


Dissolved $\text{NH}_3/\text{H}_2\text{S}$ measurement by UV spectroscopy after gas stripping – A Unique Method



Tethys Instruments

Scope of existing methods

❖ **Specific electrode**

- lower cost
- high sensitivity to interferences
- becomes polluted by waste water generating drifts
- limited lifetime

❖ **UV spectroscopy in gas phase (Tethys)**

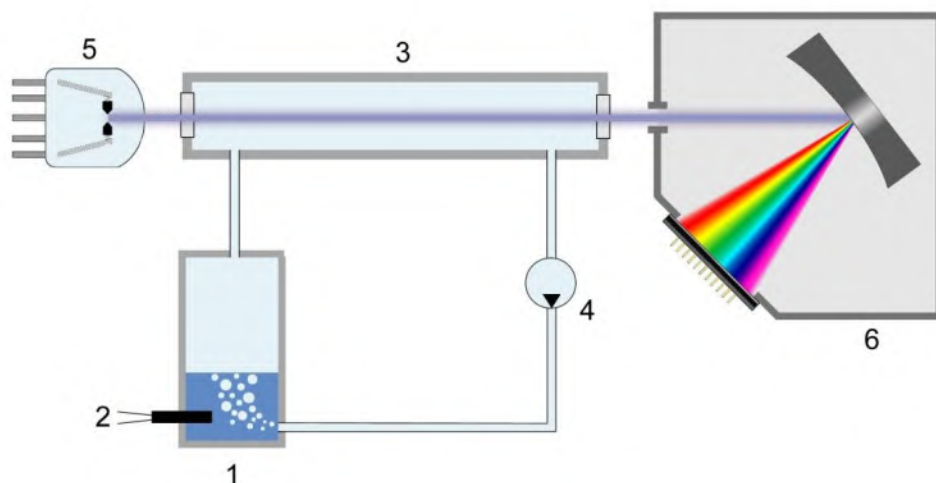
- no interference with other ion present in sample
- no sensitivity to colour or turbidity
- very low maintenance
- higher investment cost



H₂S Measurement – A unique technique

Technology: UV Spectroscopy after gas stripping

The method is based on the UV light absorbance of NH₃/H₂S in the gas phase after reaching the liquid-gas equilibrium that follows the Henry law. NH₄⁺/HS⁻ present in the water is converted in to gas phase (NH₃ or H₂S) by addition of NaOH for NH₃ and HCl for H₂S. NH₃/H₂S in gas phase is measured by UV absorption spectroscopy. The liquid-gas equilibrium is following the Henry law.



No	Element
1	Stripping pot
2	Temperature probe
3	Flow cell
4	Air pump
5	Xenon Lamp
6	Spectrograph

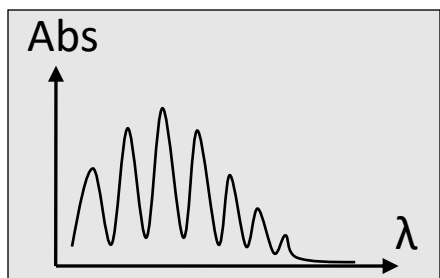
H₂S measurement – A unique technique

Principle of operation

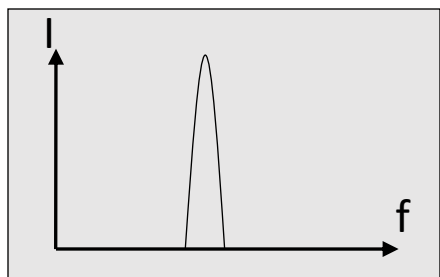
UV gas absorbance after stripping

Two methods for absorbance spectrum treatment

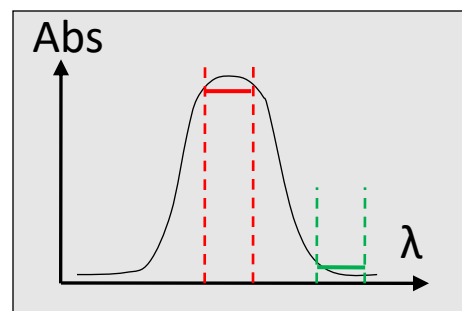
FFT for NH₄



↓ FFT



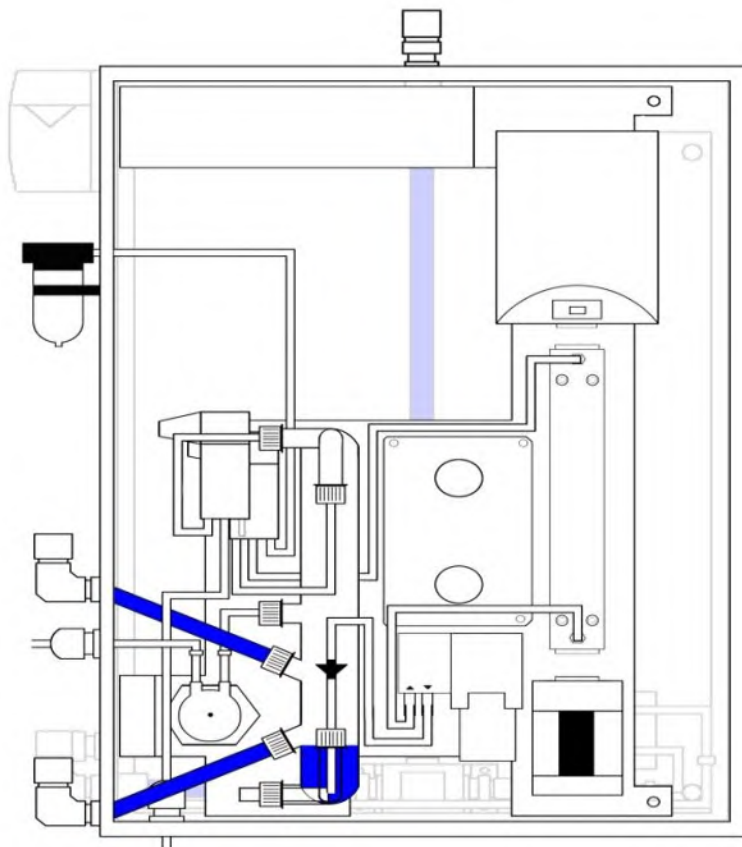
Dual wavelength for H₂S



H₂S Measurement – A unique technique

H₂S measuring cycle

STEP 1: Sampling

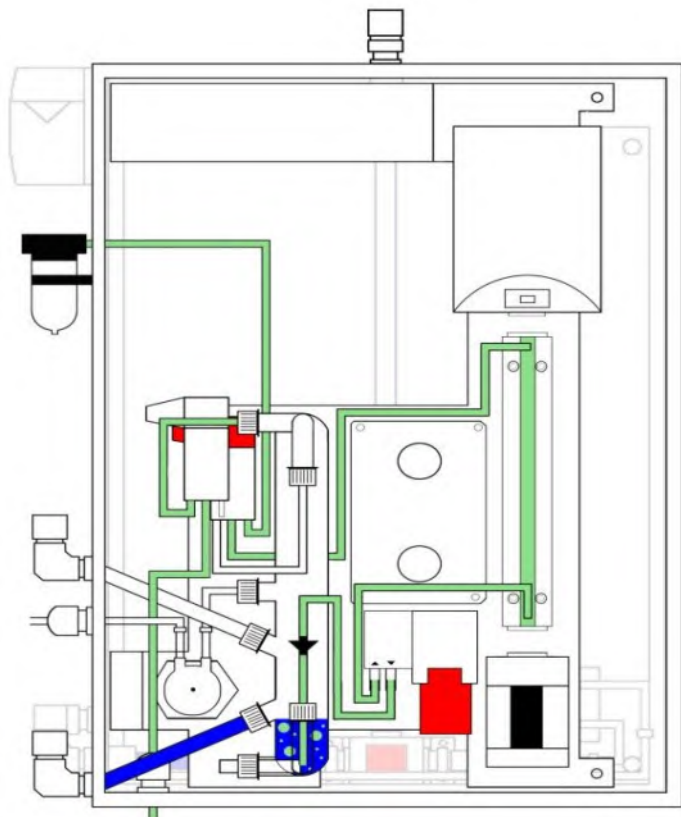


- The analyzer pumps the sample.
- The sampling time is specified on the analyzer's settings and can be changed depending the application.
- During this time of the cycle, the sampling pump is activated.

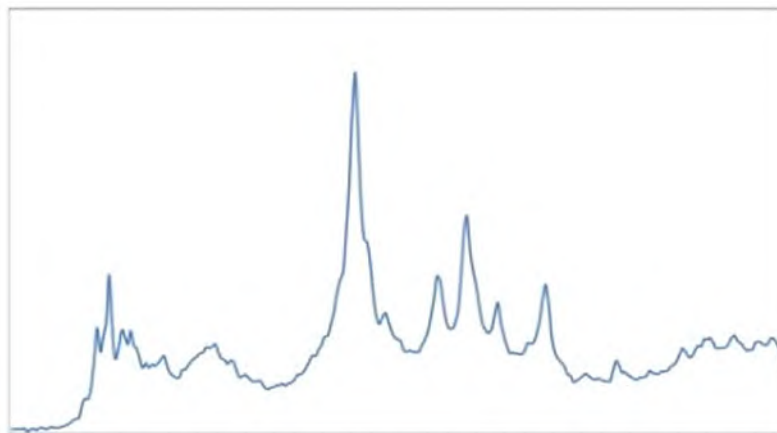
H₂S Measurement – A unique technique

H₂S measuring cycle

STEP 2: Zeroing



The analyzer purges the air circuit in order to acquire the reference spectrum of the xenon lamp. This spectrum is the lamp spectrum with zero air.

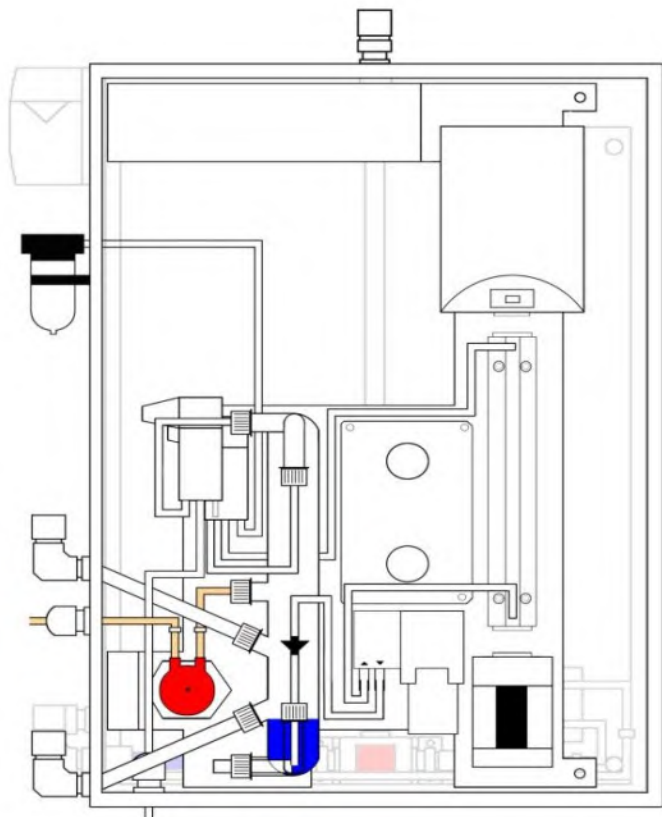


During this time of the cycle, the air pump and the EV1 are activated.

H₂S Measurement – A unique technique

H₂S measuring cycle

STEP 3: HCL addition

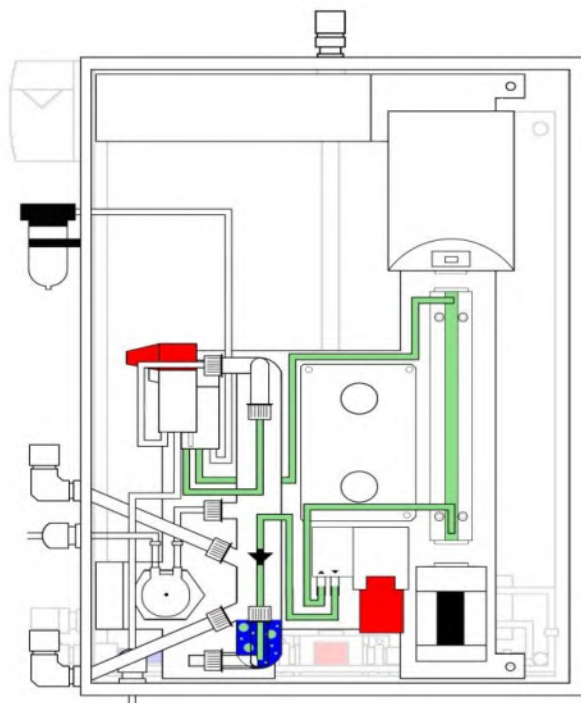


- The sample is renewed
- HCL is added into the sample. HCL is pumped during at least 2 sec to make the sample basic. $\text{pH} < 5$
- During this time of cycle, the HCL pump is activated.

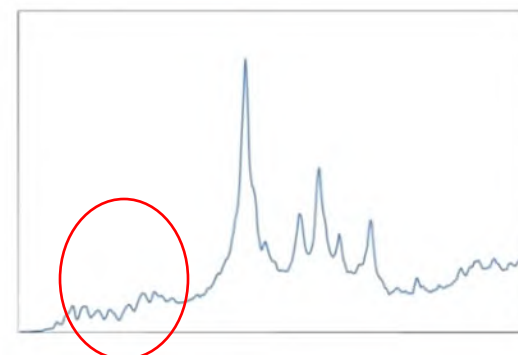
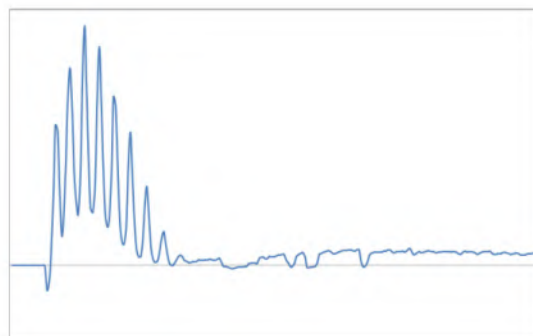
H₂S Measurement – A unique technique

H₂S measuring cycle

STEP 4 : Stripping



- The air pump is activated to strip the sample
- The HS⁻ ion is converted into H₂S in gas phase.
- The hydrogen sulfide gas circulates in the flow cell in close-circuit. EV2 is activated. T
- The analyzer acquires a new spectrum of the xenon lamp. This spectrum has the “printing” of the H₂S gas



H₂S Measurement – A unique technique

Advantages of UV spectroscopy for H₂S

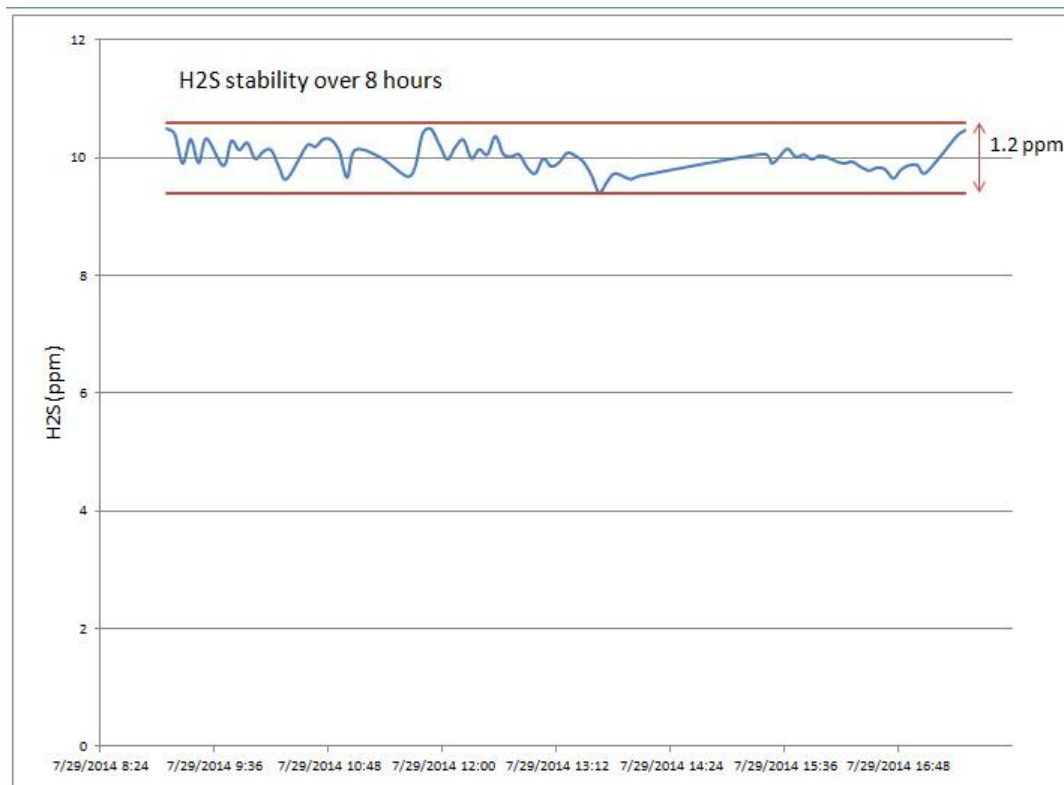
- ❖ “Drift free” method for zero as the zero is done on air before each measurement
- ❖ “Drift free” method for span/ scale as only dependent on the optical path (fixed), the sample temperature being automatically compensated using Van’t Hoff equation
- ❖ No effect of suspended solids or colour as the measurement is done on the gas phase
- ❖ Very low maintenance (no electrode to replace) – Xenon lamp has more than 10 years of life time
- ❖ Measurement free from any interference of other ion present in the sample



H₂S Measurement – A unique technique

Stability over 8 hours

- ❖ The curve below show the method stability over 8 hours on a 10 ppm H₂S standard solution



H₂S Measurement – A unique technique

Example of ATEX application on refinery



**H₂S measurement for ATEX area on refinery
(Aramco, Saudi Arabia)**



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Specialist of UV Spectroscopy