PHOTOMETER
660

3.2-Test

RIELE

391 S04(H) SULFATE (H)

50 - 300ppm \ 360 Tests

Decolorization of a Metal-Dye Colour Complex

- Fill 16mmØ tube with an extended syringe (3.2mℓ) of distilled water
- Add 2 drops of **SO_4-3.2** and mix
- Switch on the Photometer 660
- Enter [3][9][1] und press [E] for 391 S04(H)
- Set filter as indicated to 578nm and press [E]
- Insert tube and press [B]
- Add 100µℓ (0.1mℓ) of sample and mix
- Insert tube once more and press [M]
- Record as ppm (mg/ℓ) Sulfate SO_4^{2-}

In spite of the wide distribution of sulfate, the most prominent anion in water after carbonate, sulfur only accounts to ~0.04% of the rocks making up the earth's crust. Not able to be accomodated into their silicate structures, sulfur forms its own metallic sulfide phase that can at times collect locally as ore. Erosion and sedimentation oxidizes sulfides to sulfates, which combines with the alkaline earth metals from degraded silicates to form *Gypsum* with calcium and *Epsomite* with magnesium. Associated with carbon in living matter and as such in fossil fuels (with *Lignite* up to 3%), the sulfur dioxide given off on burning is discharged into the atmosphere. Here hydrolyis ($SO_2 + H_2O \rightarrow H_2SO_3$) followed by oxidation ($2H_2SO_3 + O_2 \rightarrow 2H_2SO_4$) produces sulfuric acid. This acidifies rain-water from pH 5.5 to 4.0, with soft surface waters in extreme cases exhibiting a pH down to 2.5. Trees, especially coniferous species are damaged, metal ions become liberated within the soil. Acid rain proved to be fatal for some concrete structures of the 1960s, with their outsides often left unprotected at that time. The ceramic calcium silicates and -aluminates of cements were converted to friable gypsum, with seepage of acid water into cracks generating new minerals such as *Ettringite* (SO_4-bearing Ca-aluminate) and *Thaumasite* (SO_4- + CO_3-bearing Ca-silicate). Their increased volume resulted in scaling with the periodic loss of larger pieces. Sculptures of lime- and sandstones of historic buildings could be denuded beyond recognition, concrete pipes attacked through the action of *Thiobacillus thiooxidans*. An important measure is the securement of foundations against the action of ground-waters above 600ppm SO_4. Calcium and magnesium sulfates are the major components of permanent hardness in water, with a widely accepted WHO-recommendation of <250ppm. Sulfates, especially that of magnesium have a purgative effect. Seawater contains 2700 ppm SO_4, equivalent to 7.7% of its salt content.

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