

ISO compliant Photometric Solutions for Wastewater Testing: Meet Regulations

Spectroquant[®] portfolio of products for testing key chemical parameters

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Abstract

Improper wastewater management contributes to water pollution, with 80% of global wastewater discharged without treatment. Industrial water consumption accounts for 22% of global water use, worsening the issue. Wastewater should be seen as a resource rather than a burden, with the potential to provide water, energy, and nutrients sustainably. Chemical analysis plays a crucial role in preventing environmental pollution, in compliance with wastewater standards and regulations. The Spectroquant[®] solutions offer reliable instruments and test kits for monitoring key parameters and ensuring compliance with regulations.

Introduction

Water must be carefully managed during every part of the water cycle. However, according to the World Health Organization (WHO), approximately 80% of wastewater globally is discharged into water bodies without proper treatment, contributing to water pollution and industrial water consumption is responsible for 22% of global water use, raising to 50% in Europe and North America (UN-Water, 2012). These statistics highlight the substantial impact of inadequate wastewater management on water quality. Wastewater is undervalued as a possible affordable and sustainable source of water, energy, nutrients and other recoverable materials. It therefore needs to be seen as a resource, rather than a burden to be disposed of.

High levels of pollutants in wastewater have negative impacts on plants and animals that rely on the natural water systems. Wastewater that is not properly treated can also lead to the spread of diseases and pose a health risk to people who consume contaminated water sources. Furthermore, releasing untreated or poorly treated wastewater into the environment also contributes to climate change. Wastewater treatment processes generate greenhouse gases like methane and carbon dioxide, which contribute to global warming. By ensuring that wastewater is properly treated and



controlled, we can reduce greenhouse gas emissions and mitigate the impacts of climate change.

Societal and environmental pressures over recent years have led to a growing movement for industry to reduce its wastewater and to treat it before discharge. Ensuring that wastewater is treated effectively before discharged into the environment not only saves the planet but also contributes to a more sustainable future for all.

Chemical testing is an essential practice to ensure that the environment is not polluted by harmful substances. The chemical analysis is pivotal in determining the levels of common pollutants in wastewater so that they can be treated and discharged in a safe and environmentally friendly manner.

Wastewater standards and regulations require treatment facilities to comply with minimum quality requirements to safely release treated wastewater into the environment. These standards and regulations for wastewater analysis can vary from country to country, but most are based on, or aligned to, international standards and are typically defined in national guideline values. Here are some examples of the common regulations for wastewater analysis:

- **World Health Organization (WHO) for Water Sanitation and Hygiene (WASH) Quality** – Visit [WASH page](#). These guidelines provide water quality standards to ensure that water is safe for human consumption. Unsafe water impairs health. [Guidelines can be found on the WHO website](#).
- **ISO Standards** - The International Standards Organization (ISO) has developed a series of [guidelines for environmental management](#), including ISO 14001 on environmental management systems.
- **National Pollutant Discharge Elimination System (NPDES)** - In the United States, the [NPDES program](#) requires industrial facilities to meet a set of permit limits for pollutants in wastewater discharges.

- **European Union Water Framework Directive (EU WFD)** - [The EU WFD is a regulatory framework](#) that sets environmental standards for water quality, including wastewater.

In addition to the above-mentioned national and international regulations, local regulations may also apply. These regulations can be site-specific and are designed to protect local ecosystems and public health.

In general, regulations require wastewater treatment facilities to monitor a range of parameters, such as pH, Chemical Oxygen Demand (COD), and nutrient levels, to ensure compliance with limit values. Facilities are also required to report their monitoring results regularly, and in most cases, are subject to inspections by regulatory authorities. Measurements need to be done on a routine basis and should be reliable and efficient. Our Spectroquant® line of instruments, test kits and standards enable a reliable photometric testing of key chemical parameters like COD, phosphate, nitrogen, ammonium, and disinfectants like chlorine. These easy-to-use test kits and methods support wastewater treatment facilities in controlling levels to stay within regulations.



What to test to stay compliant

Chemical Oxygen Demand (COD):

Chemical Oxygen Demand (COD) measures the amount of oxygen that is needed to break down oxidizable components and is a lead parameter to indicate pollution. High COD levels indicate high concentrations of inorganic and organic matter in wastewater, which can have a negative effect on the receiving water body. Monitoring COD levels can help treatment facilities determine the amount of treatment needed to remove the inorganic and organic pollutants in wastewater to stay compliant with regulations. The **Spectroquant® photometric COD Cell Test Kits** enable analyses of the COD in various concentration ranges, between 5 and 90,000 mg/L, in accordance with e.g., ISO 15705, APHA 5220 and EPA 410.4.

Nutrients - Nitrogen and Phosphorus:

Major nutrients in wastewater include forms of nitrogen and phosphorus which can cause eutrophication in the water body where the wastewater gets discharged to. Eutrophication is the process in which excessive nutrient concentrations stimulate the growth of algae and other plants, which can lead to oxygen depletion and consequently, harm aquatic life. By monitoring the levels of total **nitrogen** and **phosphorus** in wastewater, treatment facilities can ensure that they sufficiently remove these nutrients to prevent eutrophication.

The Spectroquant® total nitrogen cell test kits are developed for an effective photometric analysis of total nitrogen content in water in various concentration ranges, from 0.5 – 150 mg/L N, and, depending on the underlying method according to DIN EN ISO 111905-1 and DIN 38405-9 and where 2,6-dimethyl phenol is used, the method is corresponding to 2023 published ISO 23697-1.

The Spectroquant® test kits and cell test kits for ortho phosphate and total phosphorus allow an efficient and accurate photometric determination of these parameters in various concentration ranges, from 0.0025 – 100 mg/L (PO₄-P or P). The kits are in accordance with norms like EPA 365.2, APHA 4500-P E, or DIN EN ISO 6878.

Surfactants

Surfactants are additives that lower the surface tension of water such as foaming agents, emulsifiers, and detergents. Most surfactants enter the waterways as part of household waste or have their origin in industrial processes and often facilitate the introduction of other contaminants. Enhanced levels of surfactants might cause a hazard for plants, animals, and humans. Consequently, the **surfactant** test is widely employed to assess wastewater quality and ensure adherence to environmental regulations.

Ammonium:

Ammonium is another important parameter to test in wastewater. It is a form of nitrogen that is present in wastewater, mostly from human waste. In the wastewater treatment process ammonium is converted to nitrate through nitrification, which can also cause eutrophication when discharged into the environment. Testing for **ammonium** in wastewater helps to ensure that the wastewater treatment process is working effectively, and sufficient nitrogen removal is achieved. By monitoring ammonium levels, the treatment processes can be regulated to ensure that ammonium/nitrogen is removed to acceptable levels before being discharged into the environment.

The Spectroquant® ammonium test kits enable photometric measurement of ammonium in various concentration ranges, from 0.01 – 80 mg/L (NH₄, NH₄-N).

Most of the cell test kits for **ammonium**, **nitrate** and **total nitrogen** are corresponding to 2023 published ISO norms 23695, 23696-1, and 23697-1, “small-scale sealed tube methods”. Just like for **Chemical Oxygen Demand (COD)** tests kits, there are now standard norms describing the use of these cell test kits as alternative of standard laboratory methods for some of the most important water analysis parameters, increasing their acceptance for use in e.g., accredited labs.



Chlorine:

Chlorine is an important disinfectant used in water treatment facilities to kill harmful bacteria and viruses before the wastewater is released into the environment. While chlorine is not classed as a pollutant itself, its use in wastewater treatment can create potentially harmful disinfection byproducts, such as trihalomethanes (THMs) and halo acetic acids (HAAs). These byproducts can have detrimental health effects if consumed e.g., in drinking water. **Chlorine** is monitored in the wastewater treatment plants to ensure that it is used in the appropriate amounts for effective disinfection and does not create excessive byproducts affecting public health or cause environmental problems.

Reliable chlorine analysis in water is ensured by the Spectroquant® Tests for Chlorine in the concentration ranges of 0.020 – 6 mg/L Cl₂.

Further Spectroquant® test are also available to test analytes such as aluminum, calcium, chromate, cobalt, copper, cyanide, cyanuric acid, hydrogen peroxide, iron, lead, manganese, nickel, phenols, potassium, sodium, silicate, surfactants, sulfide, zinc and many more, relevant in different industrial segments.

Instruments to use

The Spectroquant® test kits for all the key parameters and more are compatible with the Spectroquant® Prove plus instruments, our benchtop range of spectrophotometers. Spectroquant® Prove plus instruments range of spectrophotometers are specifically designed for the chemical analysis of drinking water, wastewater, and process water. The Spectroquant® Prove line, **Prove 100 plus**, **Prove 300 plus** and **Prove 600 plus**, is developed for routine, sensitive, or complex analyses, respectively. These high-quality smart devices are engineered to provide reliable results with exceptional sensitivity, tailored to meet the demands of your specific application. They offer precision, speed, and easy handling. Pre-programmed for a wide range of test kits, water analysis has never been so easy and intuitive.

The Spectroquant® Move colorimeter line includes the portable models Move 100 and Move DC.

Spectroquant® Move 100 is a handheld colorimeter that offers a convenient solution for rapid onsite testing, thus, preventing deterioration of samples. It performs over 100 pre-programmed methods and allows for 35-user defined methods for drinking and wastewater analysis. **Spectroquant® Move DC** provides rapid results for 5 key parameters in disinfection control: chlorine, ozone, chlorine dioxide, cyanuric acid, and pH.

Spectroquant® colorimeters and photometers give you the sense of security you need while performing your analytic operations. These reliable and efficient systems are engineered to provide accurate results with exceptional sensitivity, tailored to meet the demands of your specific use.

Conclusion

Regulations for wastewater analysis ensure that wastewater treatment facilities comply with the relevant national or international standards and guidelines to protect human health and the environment. Compliance with the regulations is essential for wastewater treatment plants to prevent legal implications, avoid penalties and to contribute our safety and preservation of our planet.

The opportunities from exploiting wastewater as a resource are enormous. Safely managed wastewater is an affordable and sustainable source of water, energy, nutrients and other recoverable materials.

The Spectroquant® line of photometers and test kits provide an efficient and reliable support to monitor key performance parameter for process control and reporting to stay compliant with regulations.

Just prove it!

Learn more about the Spectroquant® Prove systems SigmaAldrich.com/photometry

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