Product sheet

Mütek™ PCD-06

Particle Charge Detector

FEATURES

- **Sample charge quantification through polyelectrolyte titration**
- **Acid/base titration for pH dependency determination of sample charge**
- **Compact and light for comfortable travelling**
- **Quick and easy setup**

BENEFITS

- **Shows the exact demand for chemical additives for responsible resource deployment**
- **Identifies additive overdosages or wrong reactions to save chemical additive costs**
- **Locates weak spots in water-based processes to allow purposeful improvements**
- **Merges you with a team of BTG application and service experts around the world**

GENERAL / BACKGROUND

The Mütek™ PCD-06 Particle Charge Detector measures the charge of colloidal dissolved substances in aqueous samples.

In aqueous systems, solid particles as well as colloidal dissolved substances carry electrical surface charges, a phenomenon occurring in suspensions and emulsions. These charges influence the interaction of suspended and dissolved material with chemical additives.

The charge of a sample is quantified through a titration with a polyelectrolyte of opposite charge. For this purpose, the Mütek™ PCD-06 features an integrated titrator, that can be configured with either one titration pump (variant PCD-06 Standard) or with two titration pumps (variant PCD-06 Premium). For manual titration or for the connection to an external titrator, the variant PCD-06 Light without integrated titration pumps is available.

Surface charged sample matter with a capability to accept or donate H^+ or OH^- change their charge density depending on the pH. To reveal the relation between pH and charge, the PCD can handle acid/base titrations to determine the iso-electric point (IEP) of a sample.

In the paper industry, the PCD is a standard tool for detecting anionic trash levels but also for characterizing chemical additives. Identification of charge levels is not only very important for the paper industry but also for numerous other applications like waste water treatment, the food and beverage industry, ceramics, colors, textiles and pharmaceuticals.

Use QR-code or link for more information

www.btg.com/mybtg/en/instruments/pcd-06

MEASUREMENT

Charged colloids and particles of a size > 1nm can attract oppositely charged ions from the surrounding water. Separating these so called counterions from the particle creates a measurable potential difference. If such ion separation is achieved through a liquid flow, the potential is called streaming potential with the unit mV.

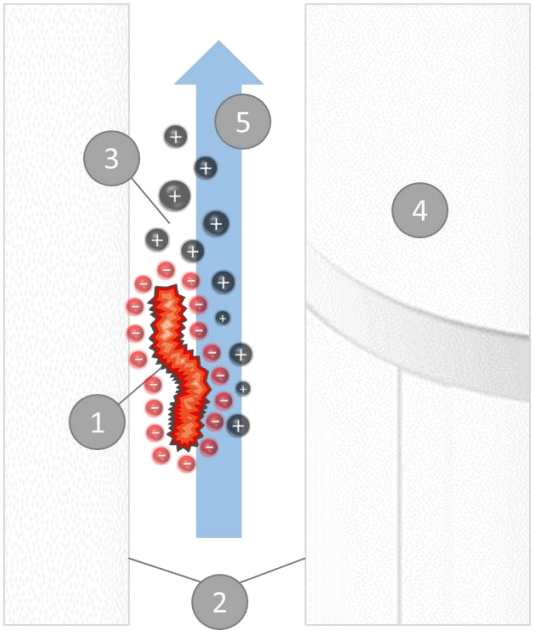

Figure 1: Inside the measuring cell of a Mütek™ PCD-06

After a sample has been filled into the Mütek™ PCD-06 measuring cell, sample colloids (1) adsorb to the inner surfaces (2) of the measuring cell, while its attracted counterions (3) remain comparatively mobile. Driven by a motor, the displacement piston (4) creates an intensive liquid flow (5), which separates the counterions from the adsorbed sample material.

At the electrodes built in the measuring cell, the counterions induce a current which is rectified and amplified electronically. A streaming potential with the appropriate sign is shown on the display.

The integrated titrator recognizes the sign and automatically adds a polyelectrolyte of opposite charge and known concentration. The poly-electrolyte addition keeps going, until the end point (EP) of the titration is reached. This is the point of neutral charge (= 0mV), where all existing charges in a sample are neutralized. Out of the known titrant consumption required to reach the point of neutral charge, the charge content of the sample is calculated and displayed as measurement result.

APPLICATION EXAMPLES

The Mütek™ PCD-06 is suitable for a wide range of applications in process control, process improvement and research, as for example in:

PAPER

Detection of anionic trash sources for a demand-oriented dosage of fixatives. Charge characterization of chemical additives like sizing agents, wet strength agents, retention aids, pigments and their processability.

PROCESS- & WASTEWATER TREATMENT

Optimization of coagulants and flocculants applied in flotation units, for process water recovery or for the treatment of industrial and municipal wastewater. All solid-liquid separations achieved through charged additives are a potential use case for a PCD measurement. It reveals the current additive demand to ensure a demand-oriented dosage.

PIGMENTS

Stability characterization of pigment dispersions like lacquers, wall colors, coating ceramics, textile colors or cosmetic fillers. The stability of pigment dispersions correlates directly to their charge at a certain pH value. Low or no charge destabilizes these dispersions and makes them at least difficult to process.

CONSTRUCTION CHEMICALS

Evaluation of the dispersing power and adsorption capability of additives and admixtures in cement, concrete, mortar and gypsum.

SAMPLE SPECIFICATION

Basically, every aqueous sample can be measured with the Mütek™ PCD-06. Once the sample is in the cell, the displacement piston can move smoothly and the detected mV-signal is comparatively stable, the sample can be measured.

To detect a streaming potential, the particle sizes in the sample should be between 1 nm and 300 µm.

High sample conductivities (larger than ~20mS/cm)

or the presence of higher valent ions (e.g. Al^{3+}) strongly compresses the streaming potential, so that an accurate endpoint detection is no longer possible. In such a case, reducing the conductivity by dilution with deionized water is recommended.

CHEMICAL ADDITIVES

Use concentrations of 0.1% (0.1 g additive plus 99.9 g deionized water). Higher concentrated solutions can be possible but depend on the viscosity of the sample (see “displacement pistons”). In case of high titrant consumption (>10ml), a dilution should be considered.

PIGMENTS, SOLIDS, FIBERS

Use concentrations of 0.1% (0.1 g solids plus 99.9 g deionized water). Higher concentrated dispersions can be possible but depend mechanical properties of particles (see also “back titration” or “displacement pistons”). In case of high titrant consumption (>10ml), a dilution should be considered.

BACK TITRATION

Depending on size, structure and stiffness, certain particles cannot be titrated directly in the Mütek™ PCD-06 since they avoid a smooth piston movement in the measuring cell. However, a quantitative charge determination of such particles is still possible by a so-called back titration. Here, the sample particles are immersed in an excess of the oppositely charged polyelectrolyte. After a certain reaction time, particles are filtered and the remaining polyelectrolyte back titrated.

ACCESSORIES

MEASURING CELL

The precision measuring cell includes a standard displacement piston with 0.1mm slots. It can take sample volumes of 10 ml – 50 ml. The core made from Teflon is reinforced by a robust outer shell made of POM (Polyoxymethylen) for lifetime fit.

SCREEN FOR FILTRATING FIBER SUSPENSION

For filtrate extraction out of fiber suspensions our beaker with a 300µm screen can be used.

TITRANT SOLUTIONS

We offer certified polyelectrolyte solutions for anionic and cationic sample titrations in concentrations of 0.001N and 0.0001N.

OPTIONS

TRANSPORTATION BOX

All Mütek™ lab devices are available with tailor-made carrying cases.

PH MEASUREMENT

To reveal the pH dependency of sample charge and the pH value of charge neutrality (IEP).

DISPLACEMENT PISTONS

Three alternative piston models are available for special application circumstances: a version with 0.5mm slots for samples that develop flocks at the point of neutral charge, a wide piston (14,95mm) without slots for higher accuracy at low charge content and a thin piston (14,65mm) without slots for higher viscose samples like e.g. polymers.

SUPPORT

LABCHECK™

Like every BTG device, the PCD-06 undergoes thorough testing before it leaves the factory. Yet it is the maintenance program LabCheck™, which keeps your lab device in perfect working order year after year. So when the service reminder pops up on your device once per year, it is time to check calibrations an replace wearing parts.

ANALYTICAL SERVICES

Besides its service to measure customer’s sample material, our application lab is dedicated to develop special applications for many different industries.

MÜTEK™ ACADEMY TRAINING

Mütek™ Academy is a customer training day, that provides you with presentations on theoretical backgrounds, instrument handling tips and application case examples. Hands-on experiments on the Mütek™ laboratory devices PCD, SZP and DFR deepen the newly acquired knowledge.

RELATED INSTRUMENTS

To establish automated process control solutions, charge measurement comes also as online SPC-5500 Charge Analyzer. To measure surface charges of solid particles, the Mütek™ SZP-10 System Zeta Potential lab unit is applied. For further information, please contact us at instruments@btg.com

TECHNICAL DATA / SPECIFICATIONS

GENERAL

Dimension W / D / H	224 / 233 / 335 mm [8.8 / 9.2 / 13.2 in]
Weight per variant	6.4 kg [14.1 lbs] (Premium) 6.0 kg [13.2 lbs] (Standard) 5.1 kg [11.2 lbs (Light)
Power supply	100–240 VAC/2.92 A / 50–60 Hz
Ambient temperature	15 – 40 °C [50 – 104 °F] No condensation
Storage temperature	5 – 40°C [41 – 104 °F]
Measuring values	Streaming potential [mV] pH
Results	Anionic / Cationic demand [ml] Charge quantity [µeq/l] Isoelectric point [IEP] pH
Sample volume	10 – 50 ml
Sample conductivity	~ 17mS/cm For sample conductivities predominately comprising of one-valent ions. Samples with higher conductivities or with conductivities comprising of higher-valent ions can be measured after dilution
Data Storage	Internal memory with capacity for 100 measurements
Output via USB	Csv file with results Csv file with titrations Csv file with parameters
Reproducibility Titration anionic vs. cationic titrant	Relative Standard Deviation SD(X)<1%
Detection limit	Up to 1ppm depending on sample specification
Communication Standards	IEEE802.3 (Ethernet)

SAFETY & DIRECTIVES

Safety and protection class

Product safety	Protection class III

EU-directives

Designed in accordance with relevant CE standards.

Quality Assurance

Quality-assured in accordance with ISO 9001.

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