pH VALUE MEASUREMENT

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The pH value is a measurement of the H^+ activity. Simply put, it is a measurement of the concentration of acid (pH ‹7) or base (pH ›7). The formal definition was formulated by chemist Soerenson:

$$pH = -\log a_{H^+}$$

The pH value is the negative decadal logarithm of the activity of protons a_{H^+} in mol/l. This value is measured by means of a pH meter with a suitable electrode in accordance with DIN 38404-C5. pH meters measure the potential difference between measuring electrodes and reference electrodes. According to the Nernst equation, the potential difference changes by 59 mV per pH unit. The pH meter must be calibrated regularly from time to time. The calibration is carried out by means of standard buffer solutions with defined pH values.
During a 2 point calibration, the zero point is set by an additive correction with the buffer solution (pH=7). Subsequently, the end value (e.g. pH=4.01) is set over a multiplicative correction (transconductance). How often the meter should be calibrated depends on how exact the measurements should be and varies from meter to meter. If the pH meter is not in constant use, it should be calibrated before every measurement. If the electrode is continuously in the storage liquid, it doesn't have to be calibrated as frequently. For each calibration, 20 ml of buffer solution are needed. Solutions should not be used more than once. The bottles containing the buffer solution must be sealed immediately after use. Alkaline calibration solutions are more sensitive. Their pH values change because they absorb CO_2 from the air. A sealed bottle of buffer solution keeps for several months to two years. Between calibrations or measurements, the sensor must be rinsed with distilled water but not wiped off. Excess drops can be dabbed away with a soft cloth.

The pH value is temperature-dependent; therefore the temperature must always be recorded along with the entry of the pH value. Nowadays most pH meters are equipped with a temperature measuring unit. This allows the temperature influence to be compensated during the measurement.

A pH meter requires regular maintenance to measure optimally.

With electrodes with refillable electrolyte, the fluid level of the electrolyte solution must be checked. The level of the reference electrolyte must always be a few cm above the fluid level of the measurement solution. If necessary, the KCl solution 3M must be refilled after removing the seal over the filler hole. During use, the refill hole for KCl should always be open, otherwise the solution cannot be diffused out. If the electrode is no longer needed, it should be quickly rinsed, the refill hole for KCl should be sealed and the electrode should be stored in the 3M KCl solution so that it doesn't dry out.

During transport and storage, KCl solution can leak out of the protective cap, out of which crystallised white potassium chloride is formed. This salt deposit has no effect on measuring accuracy and can be easily washed off with water. If the electrode is dried out, then it must be soaked in 1ML HCl and subsequently reactivated for several hours in 3M KCl.

Should constant deviations be determined during measurements, the electrode must be checked for possible contamination. Depending on the type of contamination, different cleaning measures are recommended.

- *To clean off fat or oil deposits, the membrane must be degreased with cotton which has been soaked in acetone or soap solution.*
- *If protein has settled on the diaphragm, the electrode is soaked in HCl/Pepsin solution for approx. 1-2 hours.*
- *In case of a silver sulphide contamination, the electrode is to be set in a thiocarbamide solution and left to soak.*
- *To remove inorganic films, the electrode is dipped into 0.1 M HCl or 0.1 M NaOH. With 40-50°C solutions, cleaning is more effective.*
- *After every cleaning procedure, the electrode is to be set in a 3M KCl solution about a quarter of an hour a new conditioning and subsequently calibrated once again.*