

## The advantages of pH measurement with pH electrode vs. colorimetric detection

The most common titration methods in modern fully automatic distillation units are the pH determination via colorimetric detection and the pH measurement with a pH electrode based on the electrochemical measurement. Both methods are generally suitable for automatic systems. The measurement with the pH electrode has the significant advantage that it monitors continuously the actual pH of the solution. Thus C. Gerhardt instruments like the VAPODEST® 50s using pH-electrodes for the titration. Combined with multiple other advantages it is the perfect method for fully automatic systems:

- accurate results - electrochemical measurement monitors the real pH in the titration solution + possible to display the pH graph
- highest possible reproducibility
- high flexibility - any concentration/amount of acid possible

Additionally the method eliminates the biggest limitation of the colorimetric detection:

- no sensitivity against light (e.g. illumination of the laboratory)
- no experience with the handling of indicator solution necessary
- no expensive indicator solution needed
- no adjustment of the receiver solution

**C. Gerhardt pH measurement fullfills at minimum, the accuracy criteria specified recovery and repeatability by official national and international standards.**

Certainly the pH measurement applied by C. Gerhardt is mentioned modern national and international Kjeldahl norms, e.g. ISO 8968-1:2014 (IDF 20-1:2014) - Milk and milk products - Determination of nitrogen content - Part 1: Kjeldahl principle and crude protein calculation.

As a marketing and sales tool we have created a chart with a brief comparison of both methods and an additionally graphic to show the key difference between the pH measurement with a pH electrode and the colorimetric detection.

	pH-Measurement with pH-electrode	colorimetric detection
Basic principle	pH electrode detects exact pH via electrochemical measurement	indicator solution changes color at a certain pH → optical sensor detects change of color
possible to display the pH by numerical value	✓	
pH graph can be displayed graphically	✓	
exact measurement of real pH value	✓	
can be used in traditional norms/methods	✓	✓
can be used in fully automatic systems	✓	✓
Limitations in a fully automatic system*		✓
automatic addition of titration solution	✓	✓
entire titration process visible for operator	✓	

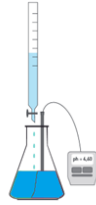
\*e.g. optical sensor requires a closed system to protect against light

Comparison chart – pH measurement with pH electrode vs. colorimetric detection

pH Measurement with pH electrode

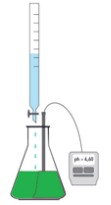
Colorimetric titration with indicator

Start of titration



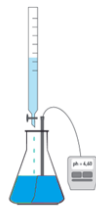
Addition of titration solution

Start of titration



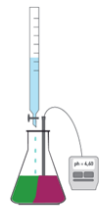
Addition of titration solution

pH electrode measures continuously exact (real) pH



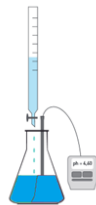
Device detects end-pH

Indicator reacts at a certain pH level

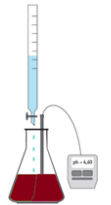


Optical sensor detects change of the indicator color → conversion to pH

Calculation of consumed titration solution



Calculation of consumed titration solution



Comparison – pH measurement with pH electrode vs. colorimetric detection