

Stabino® Zeta Potential – Titrations

now from 0°C to 90°C - and condensation-free.

Abstract

New for the Stabino® Zeta Potential Titrator is, that charge titrations can be performed at fix temperatures. Titration with stability changing solutions reflects the stability of dispersions, emulsions and colloidal solutions. The examples show that the determination of the zero point of charge provides the most reliable statement on stability analyses. The absolute value of the zeta potential is calculated by theoretical assumptions that may apply for definite formulations but can mostly not be defined in reality. Therefore, in contrast to a zero point of charge titration the zeta potential value is more suitable for comparing of already known samples.

Main Part

With the new temperature control module changes of stability can be simulated by temperature stress (**Figure 1**). These happen typically at processing, storing and transport of the products. As example, measurements on milk (**Figure 2** and **Table 1**) and beer (**Figure 3** and **Table 2**) at different temperatures were chosen. A condensation at the measuring cell cannot occur as the measurement of the zeta potential is carried out in the sample.



Figure 1: Stabino® with temperature control module

Example milk: The IEP (isoelectric point) is temperature dependent and shows the denaturation.

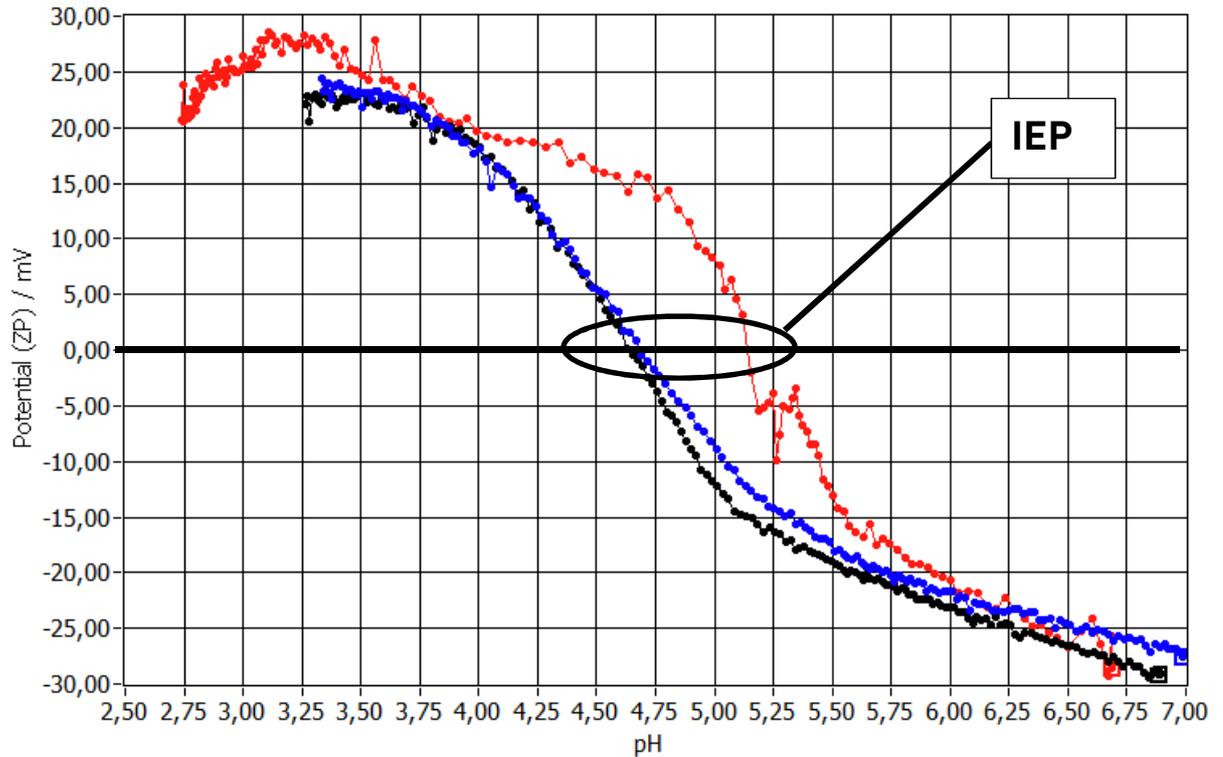


Figure 2: pH Titration at 10°C (blue), 25°C (black) and 60°C (red) of milk

Table 1: Titration data of the pH titration of milk

	T = 10°C	T = 25°C	T = 60°C
IEP	4.7	4.6	5.1
V (0 mV) HCl 0.01 N	5.36 mL	5.56 mL	4.91 mL

Example Pils beer: Importance of the zero point of charge determination (ZPC) in contrast to pure zeta potential determination.

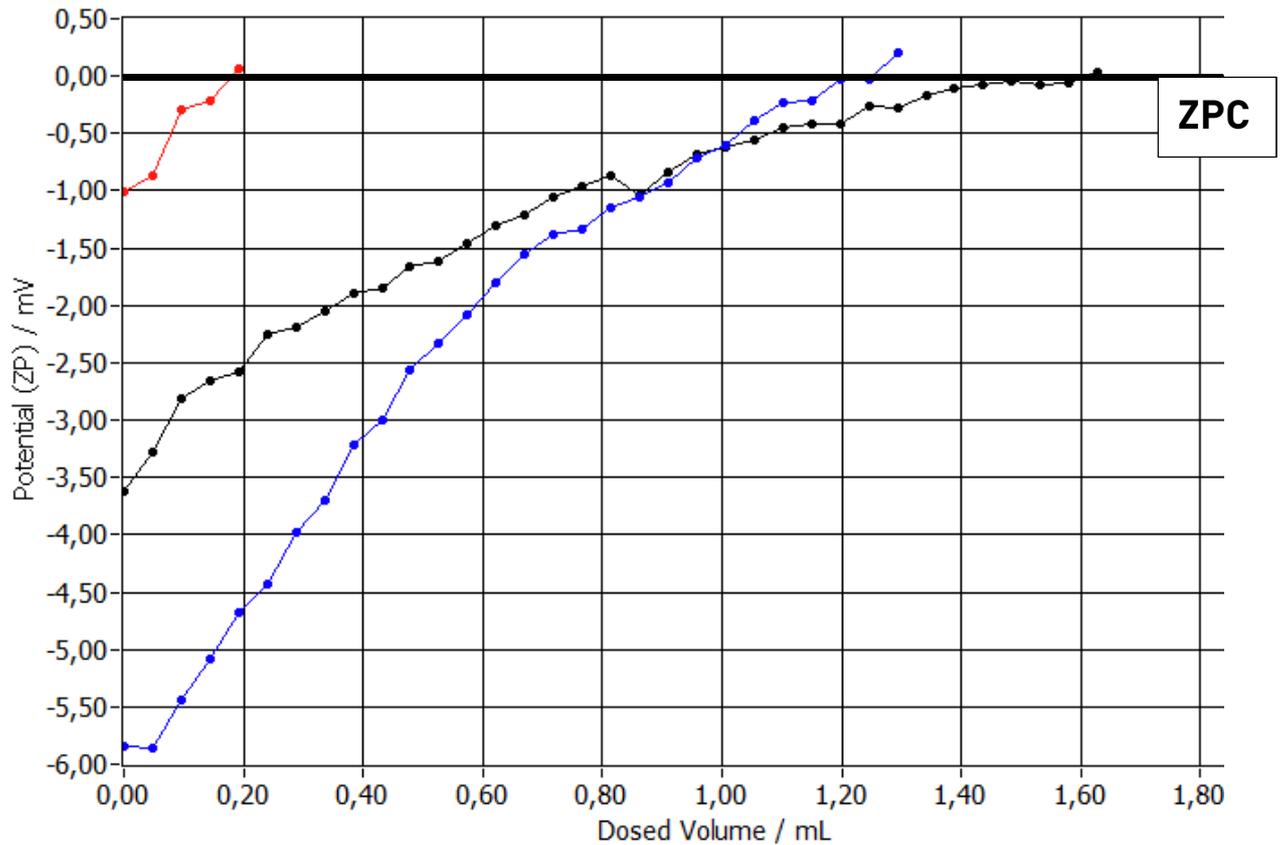


Figure 3: PE titration at 10°C (blue), 25°C (black) and 60°C (red) of beer

This shows that the zero point of charge provides the most reliable information on the prediction of stability. Reason: The ZP is expected the lowest at 10°C. But there is no known formula that considers a process at low temperature.

Table 2: Titration data of the PE titration of beer

	T = 10°C	T = 25°C	T = 60°C
Zeta potential (mV) at V (0 mL)	-5.8 mV	-3.6 mV	-1.0 mV
V (0 mV) P-DADMAC 0.001 N	1.250 mL	1.609 mL	0.179 mL

Example W630 (Al₂O₃) is a commercial product by Evonik Degussa as example for a product with clear zeta potential calculation.

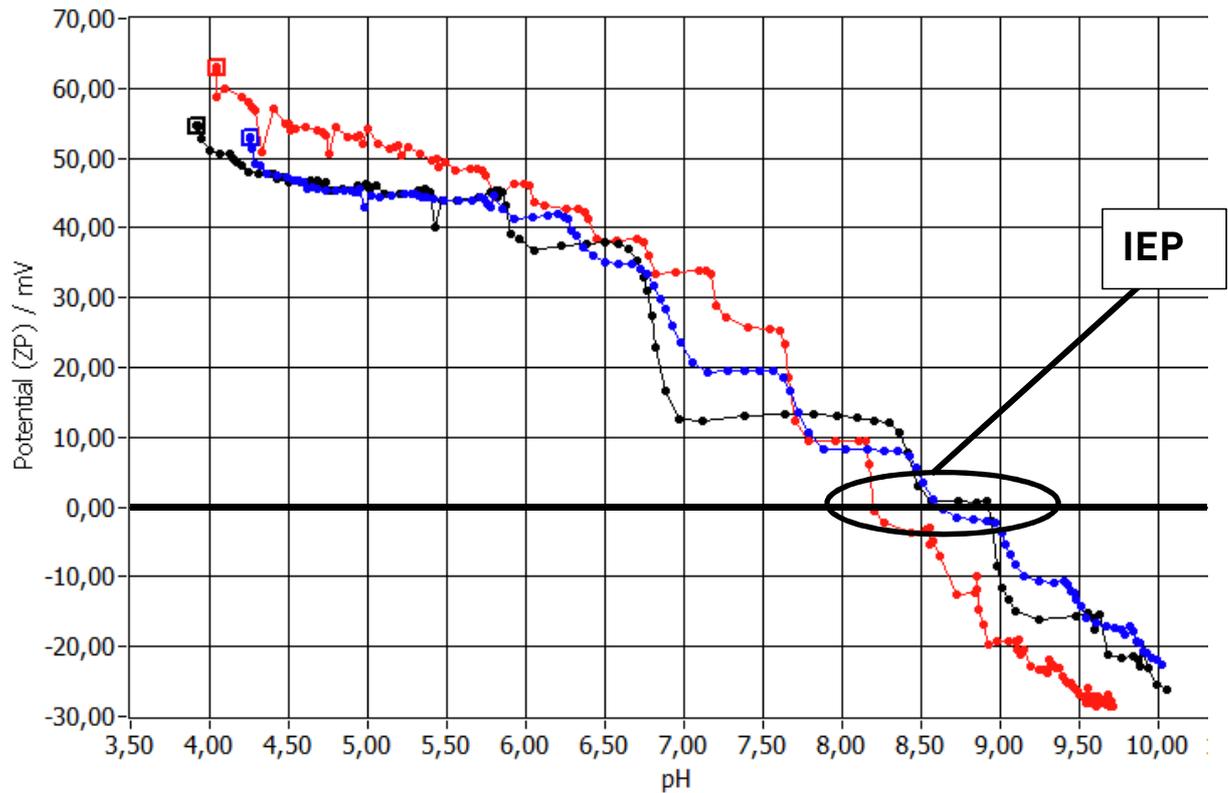


Figure 4: pH titration at 10°C (blue), 25°C (black) and 60°C (red) of W630

Table 3: Titration data of the pH titration of W630

	T = 10°C	T = 25°C	T = 60°C
Zeta potential (mV) at V (0 mL)	53.1 mV	54.6 mV	63.2 mV
V (0 mV) NaOH 0.001 N	4.706 mL	3.955 mL	4.302 mL
IEP	8.6	8.9	8.2

In principle, for the titrations either 10 or 1 mL sample volume is needed. The adjustment of the desired temperature takes up to 25 min dependent on the chosen temperature and environmental conditions.

Conclusion

In many aspects it is important to measure the influence of the temperature on the stability of the sample at real temperatures. The zeta potential proves itself as a useful monitoring signal. In contrast, its absolute value is less suitable as stability parameter. The isoelectric point or the consumption of titrant to reach the zero point of charge provided the most information about stability.

Charge titrations with the often used optic-electrophoretic methods are time-consuming and therefore often avoided. With the Stabino®, titrations are possible in 5 to 10 minutes. Often no dilution of the sample is necessary. Bubbles and other influences on the measuring comfort do not effect or delay in the analysis.

Not to forget that the Stabino® is unsurpassed in the size measurement range compared to all other measuring methods. From 0.3 nm – macromolecules → nanoparticle suspensions → emulsions → up to 300 µm fibres.

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Colloid Metrix is constantly trying to adjust its products to new findings and therefore allows for changes of products without further notice.