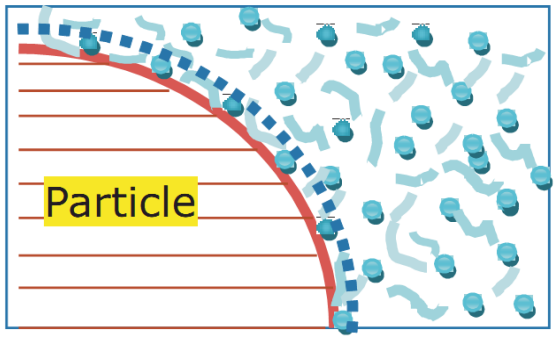
PARTICLEMETRIX

C11 - Zetapotential distribution of 1 nm particles

Below 5 nm, due to lack of signal, with most analytical systems it is difficult to measure electrokinetic potentials (EKP). Either the particles and macromolecules (NPs) are too small or the concentration is too low. With Stabino® and ZetaView® the analysis is possible in many cases.

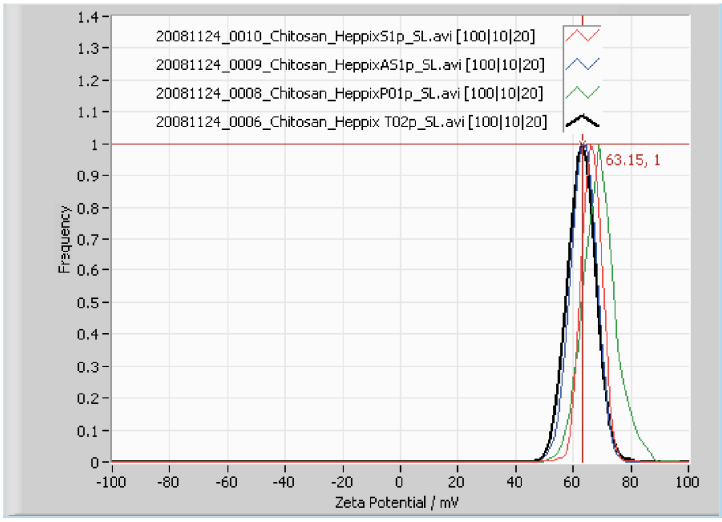
As long as the concentration is above 0.02%, with the Stabino® streaming potential arrangement, it is easy to get an EKP signal, even from sub nano-sized NPs. In addition, charge maps like interface potential versus pH, polyelectrolyte or salt ion concentrations are quickly made. A titration with an anionic PVS polyelectrolyte solution is shown further down in the text.

The feature of the ZetaView® instrument to distinguish between individual particles, offers an interesting opportunity for measuring zeta potential of nm sized particles and macromolecules. The only condition is that a few particles of > 80 nm for direct detection are present. In general, due to the adhesion of the nm particles to interfaces (brown), these few big particles show the charge characteristic of the nano-environment (blue dotted line).

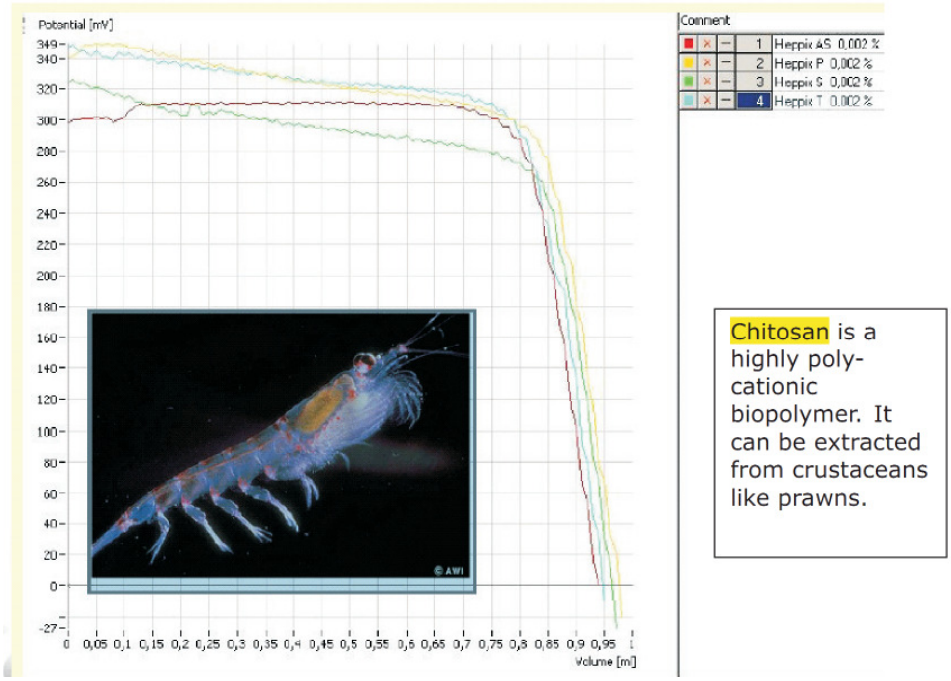


Chitosan 0.95 nm DLS size, + 63mV zeta potential

The size of the cationic macromolecules of a 1% chitosan solution was measured with the NANO-flex 180° back scattering DLS of the Stabino®. There were just enough agglomerates or other particles present to perform the zeta potential measurements by nano-particle tracking analysis. Four different samples were compared to each other. All samples showed zeta potentials near 60 mV.



To make sure, that the results obtained with the ZetaView® are reasonable, titrations with charge calibrated anionic PVS solutions were performed in the Stabino®. The end point was 0 mV. It is known that the streaming potential at the starting point as well as the consumption of counter polarity poly-electrolyte to the zero point of charge correlate to the zeta potential. As in the ZetaView® particle tracking analyzer, the results on the same 4 samples showed a high potential and the same trend.



Some other results obtained with ZetaView® below 50 nm

The data show that ZetaView® particle tracking analyzer is a useful alternative to study the zeta potential of nanoparticles and macromolecules.

ZP results of nano-colloids

measured with ZetaView Laser Scattering Video Microscope

Sample	Size*) / nm	ZP average /mV	peak #1 /mV	Peak #1 /%	Peak #2 /mV
Chitosan	0,95	63			
SiO2 #1	30	-37			
SiO2 #2	30	-52	-55	90%	-22
Humic Acid	50	-57,8			
Au Colloid NIST	29	28,7	-29,9	75%	-10
Ag Colloid	2	-29			

In addition, it may serve to calibrate the streaming potential of the Stabino® to zeta potential, if needed. Having said this, it should be pointed out that the « real » zeta potential at the slipping plane of the double layer obtained from electrophoretic mobility measurements is questionable below approximately 200 nm. The lower the particle size is, the less applicable is the Smoluchowski formula. We leave it up to the scientists to find the best answer to this problem. In practice, the ZetaView® zeta potential and Stabino® streaming potential complement each other very nicely. One method shows distributions, the other is very efficient for charge titrations on concentrated samples.