MICROTRAC MRB
PARTICLE CHARACTERIZATION

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CHARACTERIZING HIGH CONCENTRATION PIGMENTS & INKS

Experienced formulators are familiar with the challenges of working with pigments and ink emulsions. The complex interactions between such particles and their suspension medium may have led you to ponder the following questions:

- Will diluting my pigment or ink emulsion affect how particles interact? Should the concentration of my analytical sample match my process concentration?
- Will there be effects of agglomeration or flocculation? If I dilute my solution, are the Zeta Potential (ZP) values still viable to determine stability?
- What effects do pH and conductivity values have on my samples? What is the Iso-Electric Point (IEP) for my emulsion?
- How can I determine an exact amount of the titrant needed to create a good formulation for stability? What is the in-situ particle size?

Understanding all these factors unleashes a new potential for your development process. NANOTRAC FLEX and STABINO ZETA from Microtrac MRB simultaneously provides: Particle Size, Streaming Potential, Zeta Potential (ZP), Conductivity, pH, & Temperature.

Commercial refillable black printer ink undiluted (left), diluted 1 : 10,000 (middle), and diluted 1 : 1,000,000 (right)

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NANOTRAC FLEX Dynamic Light Scatter (DLS) instrumentation has a unique external probe with 180° heterodyne configuration. The laser-amplified scattering reference method has superior signal-to-noise sensitivity, detecting a more versatile range of concentration and size modalities. Figure 1 shows duplicated size distribution data for the undiluted black ink. Figure 2 shows the affect of sample dilution, at a rate of 1 : 10,000. Although the data are repeatable, the precision of the measurement is questionable. Sample dilution leads to a significant loss of information.

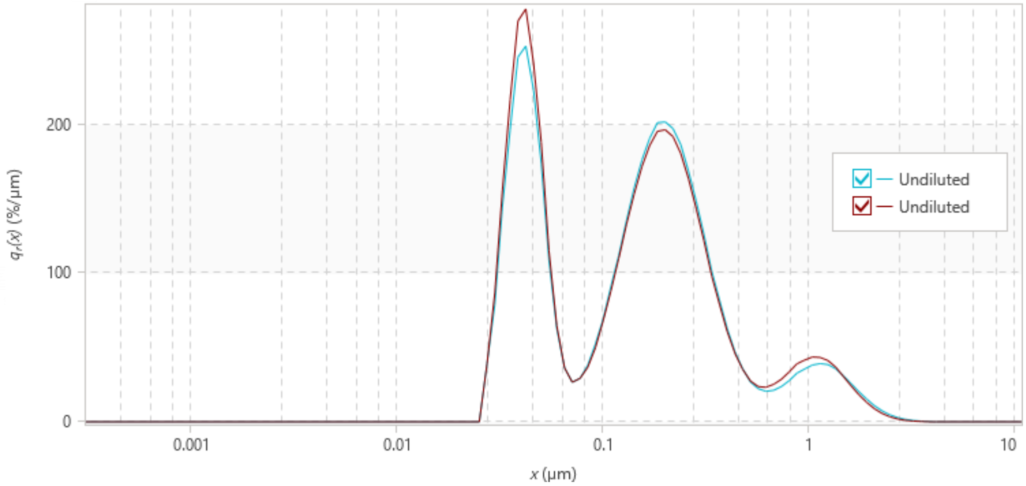

Figure 1 is the intensity-weighted particle size distribution for undilute black ink. Particle modalities were observed near 40 nm, 250 nm, and 1.2 µm

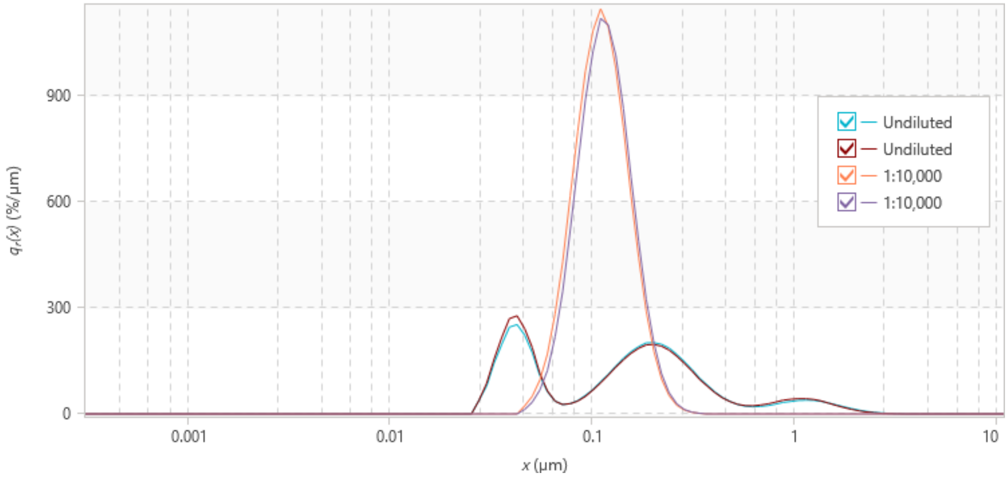

Figure 2 is the comparison of intensity-weighted particle size distribution for undilute black ink, and 1:10,000 dilution.

Ask yourself, which set of data would you prefer when creating a new formula? Would you feel confident controlling a process with diluted data? Do your current DLS measurements require dilution?

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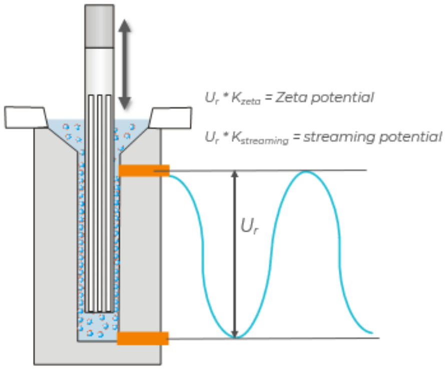
STABINO ZETA instrumentation utilizes the streaming potential method, requiring no prior knowledge of optical or dielectric sample qualities. The mix-and-measure operation prevents sedimentation, allowing charge mapping of particles ranging from 0.3nm to 300µm. Selectable piston gaps accommodate a range of viscosities as well. The built-in titration capabilities are a powerful tool to determine IEP, optimize dispersion, or control flocculation. Figure 3 shows the affect of dilution. Again, the data are repeatable, but with questionable precision. Zeta potential measurements are only relevant in the context of other conditions sample, especially concentration.



STABINO ZETA streaming potential schematic

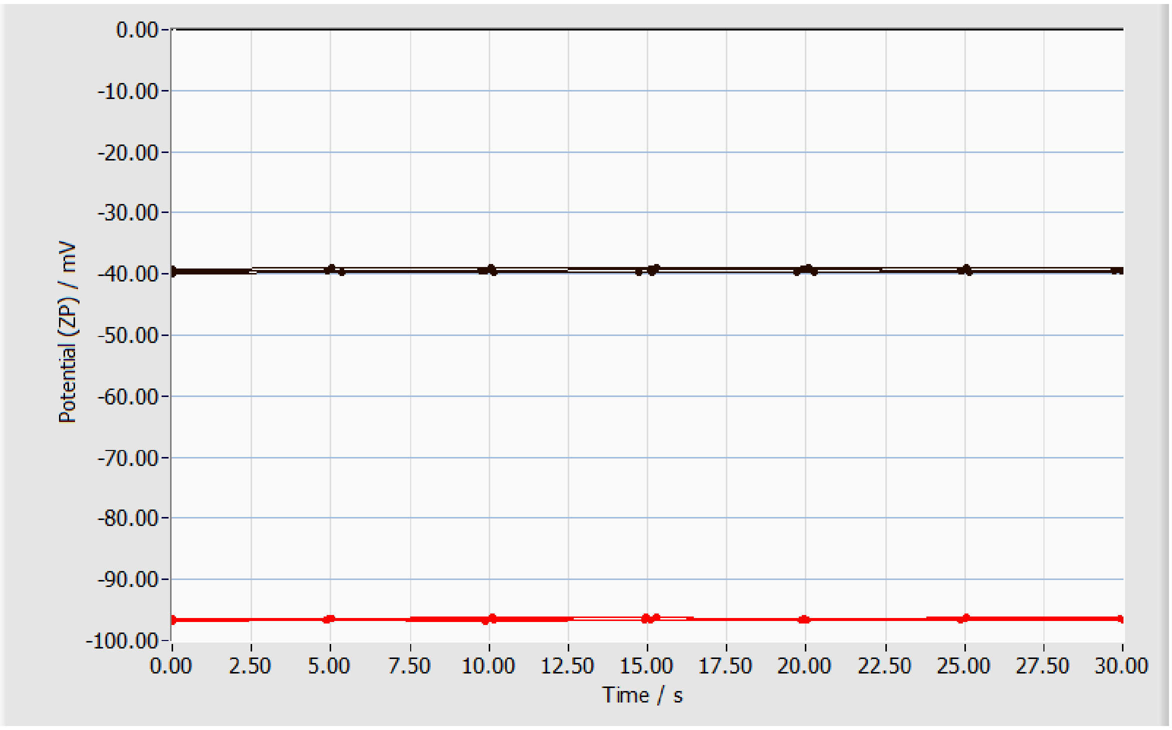


Figure 3 shows zeta potential in millivolts, collected over a 30 second time period. The **black** lines represent undiluted ink, where the **red** lines represent the same ink at 1 : 10,000 dilution.

Ask yourself, which set of data would be most useful to understand emulsion stability? Do your current zeta potential measurements require dilution? Have you related pigment and ink emulsion stability to printing performance?

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Each component of pigment and ink emulsions has specific function, like maintaining color, intensity, or viscosity. Balancing these components properly can make the difference between a quality print and a clogged printer head.

STABINO ZETA titration capabilities are a powerful tool to determine particle charge behavior for a range of conditions. Figure 4 shows data from an experiment to determine IEP for an undiluted commercial black ink.

Optional accessory, 10ml black beaker

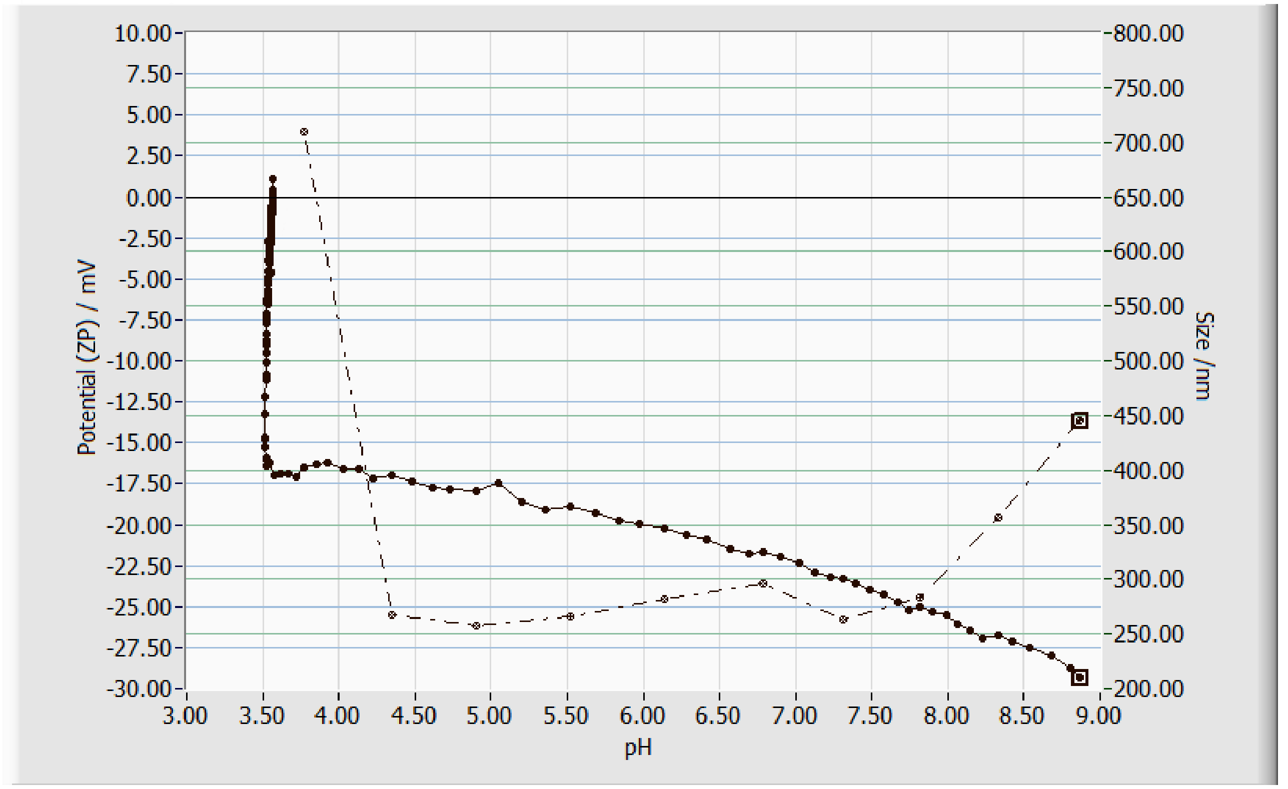

Figure 4 is a plot of zeta potential and particle size. The initial pH = 9.0 is modified with 1.0N HCl to an endpoint of pH = 3.50. The primary axis (left) displays ZP in millivolts and corresponds to the solid black line. The secondary axis (right) displays mean intensity weighted particle size in nanometers and corresponds to the dashed black line. The IEP is observed at pH = 3.5, and generally the formulation is unstable below pH = 4.5

Ask yourself, how do you evaluate raw materials? How do you optimize the type and amount of dispersant? Does your current analytical capability include the features the STABINO ZETA and NANOTRAC FLEX can offer?

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