AccuSizer 780 系列仪器在喷墨墨水粒度检测中的应用

综述

喷墨墨水的色素是在溶液中呈胶态分布的。色素的一定分散对避免沉降、不稳定或结块引起的喷墨失败都是很有必要的。为了确保最佳配比并生产，我们需要一个可靠的方法来确定最终产品的粒度分布。PSS 的 AccuSizer 系统——单颗粒计数原理(SPOS)是一个理想的工具，它可以测出喷墨墨水是否包含任何可能构成阻塞喷射器、导致性能降低等风险的粒子。本应用阐述了 AccuSizer 在解决喷墨墨水制造业方面问题的一些例子。

引言

The pigments formulated into inkjet inks are typically dispersed to small particle sizes (between about 50 and 200 nm, depending on the application) and need to be made colloidally stable. The colloidal stability can be achieved either by surface modification to form an adequate surface charge (zeta potential), or by adsorption of certain compounds on the surface of pigment particles (steric stabilization).

将色素按配方加入到墨水中通常要分散成小颗粒形式（大约在 50 到 200nm 之间，根据应用不同而变化）并且需要呈胶态稳定。这种胶体稳定状态可以通过修饰表面形成适当的表面电荷(Zeta 电位)来实现，也可以通过色素颗粒表面吸附一定量的化合物（空间稳定性）实现。

The size of the pigment particles is critical because large particles may

plug the jets and channels, causing damage to the print head. Controlling the large particle content (> 0.5-1.0 μm) requires having a technique that is sensitive to a small number of large particles—the tail of the distribution.

色素颗粒的大小非常重要，因为大颗粒会阻塞喷射器和通道，对印刷头造成损害。对大颗粒 (> 0.5-1.0 μm) 含量的控制就需要一个对极少量大颗粒敏感的方法——尾部大颗粒的分布

Particle Sizing and Counting Techniques

颗粒大小和计数方法

There are several methods for determining the mean particle size of ink dispersions such as dynamic light scattering (DLS), but most are not capable of determining small amounts of oversized material. Methods that are based on sizing and counting individual particles are particularly well-suited for this type of analysis, where even small amounts of outliers are sized and counted in the process.

有很多方法可以测定油墨分散体的平均粒度，比如光散射法(DLS)，但是这里的大多数方法并不能测定出少数的大颗粒。而基于单颗粒计数的方法就特别适合这类分析，测试中甚至可以测出极少量异常值的大小和数量。

The AccuSizer single particle optical sizing (SPOS) system is ideal for quantifying the size and concentration of large particle tails present in

inkjet inks. Depending on the sensors incorporated the system can cover a dynamic range of 0.15-400 µm. The system shown in Figure 1 includes the standard LE400 light extinction and scattering sensor that measures from 0.5-400 µm mounted in the AD sampler that provides automated dilution of the sample to the optimum concentration for the measurement.

AccuSizer 的单颗粒计数技术(SPOS)可以很好地对油墨中大颗粒定量大小和浓度，具体取决于传感器的检测范围。系统如图 1 所示，包括标准的 LE400 消光和散射传感器——可以测定加入到可自动稀释样液的 AD 采样器的 0.5-400µm 之间的颗粒，也可以测定试验的最佳浓度。

图 1：AccuSizer 780 AD

Application Example 1: Effect of Stirring

应用实例1：搅拌的作用

There are many factors that can impact pigment dispersion one of which

is stirring time. It is necessary to determine an optimal stirring time to reduce the number of oversized particles within a dispersion. It is also important to monitor stirring time since over homogenization can lead to increased particle size.

有很多因素会影响色素的分散，其中之一就是搅拌时间，因此，很有必要设定一个最佳搅拌时间以减少分散系中的超大颗粒。同时对搅拌时间的控制也很重要，因为过度均质会导致粒度增大。

Two pigment dispersions, magenta and cyan, were analyzed to monitor the effects of stirring time on oversized particles. The figures 2 and 3 show the results for the magenta sample that was stirred for 50, 70 and 90 minutes. The tail particles decreased from 4 x 10^6 particles/mL to 2 x 10^5 particles/mL.

我们用两种色素分散液样品—红色和蓝色溶液，来研究搅拌时间对超大颗粒的影响。图 2 和 3 显示了红样液分别搅拌 50、70 和 90min 的结果。尾部颗粒从 4 x 10^6 particles/mL 减少到了 2 x 10^5 particles/mL。

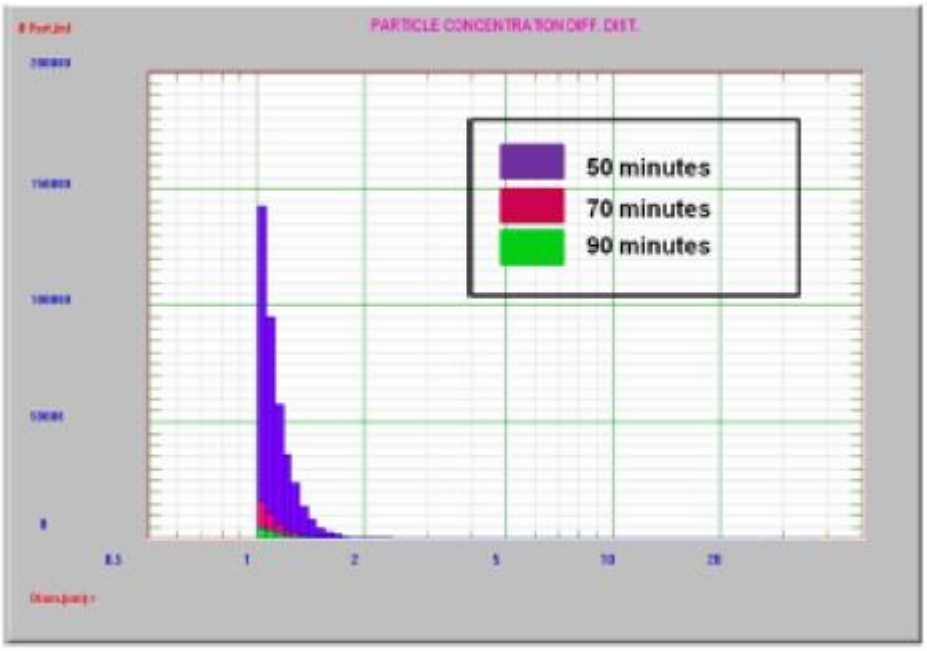

Figure 2: Effect of stirring on magenta sample

图 2：搅拌对红色溶液的影响

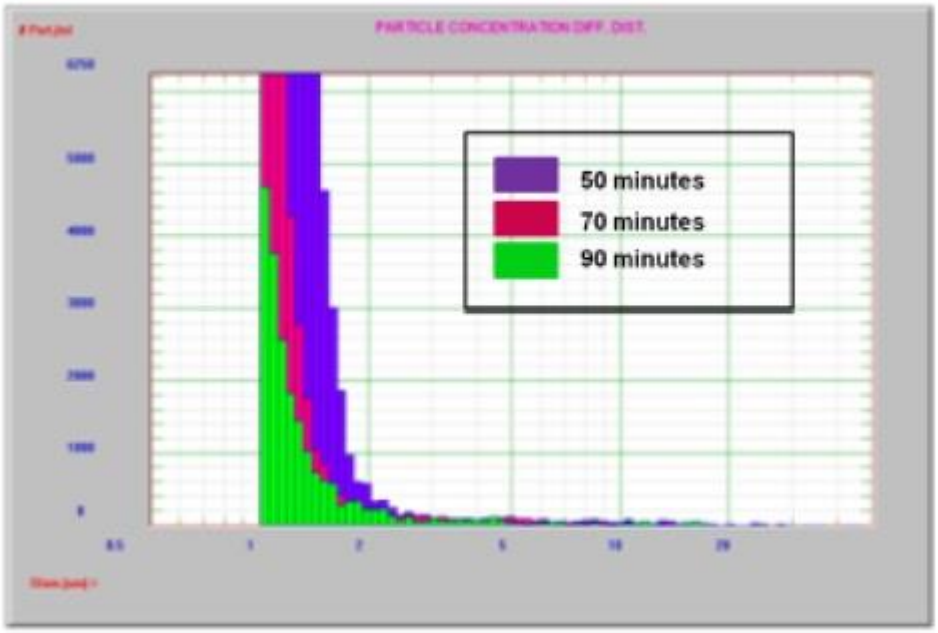

Figure 3: Expanded view of magenta sample

图 3：品红溶液结果的放大图

Concentration of large particles > 1 μm:

大于>1μm 颗粒的浓度：

50 min: 4 x 10^6 particles/mL

70 min: 5 x 10^5 particles/mL

90 min: 2 x 10^5 particles/mL

The cyan sample shown in Figure 4 also undergoes a decrease in the number of oversized particles with stirring time. The concentration of particles decreases from 9 million particles/mL to approximately 3 million particles/ mL with just 10 additional minutes of stirring.

图 4 所示的蓝色溶液，同样存在随着搅拌时间延长而超大颗粒减少的现象。多搅拌了 10min，颗粒浓度就由 9 x 10^6 particles/mL 减少到大约 3x 10^6 particles/mL。

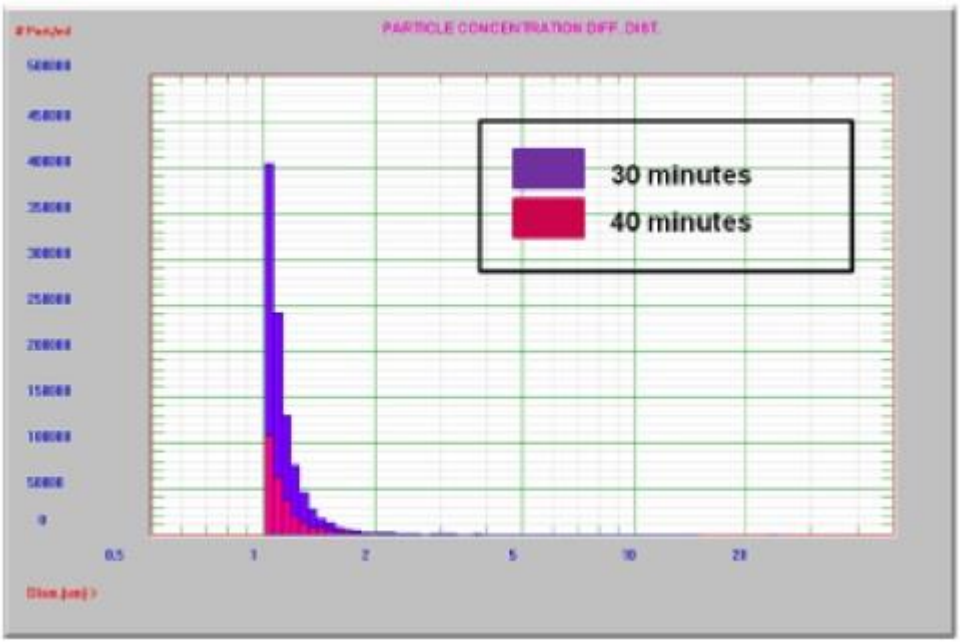

Figure 4: Effect of stirring on cyan sample

图 4：搅拌对蓝色溶液的影响

应用实例 2：过滤的作用

这个例子显示了过滤前后试验的结果，试验中将喷墨用 2 微米和 5 微米的过滤器进行过滤，如图 5. 两种过滤器都显示可以大大提高对大于 1 微米颗粒的过滤作用。未经过滤的样品中大于 1 微米的颗粒浓度大于 100,000 个/mL，而经过 5 微米、2 微米过滤器过滤的样品分别大约为 70,000 和 20,000 个/mL。

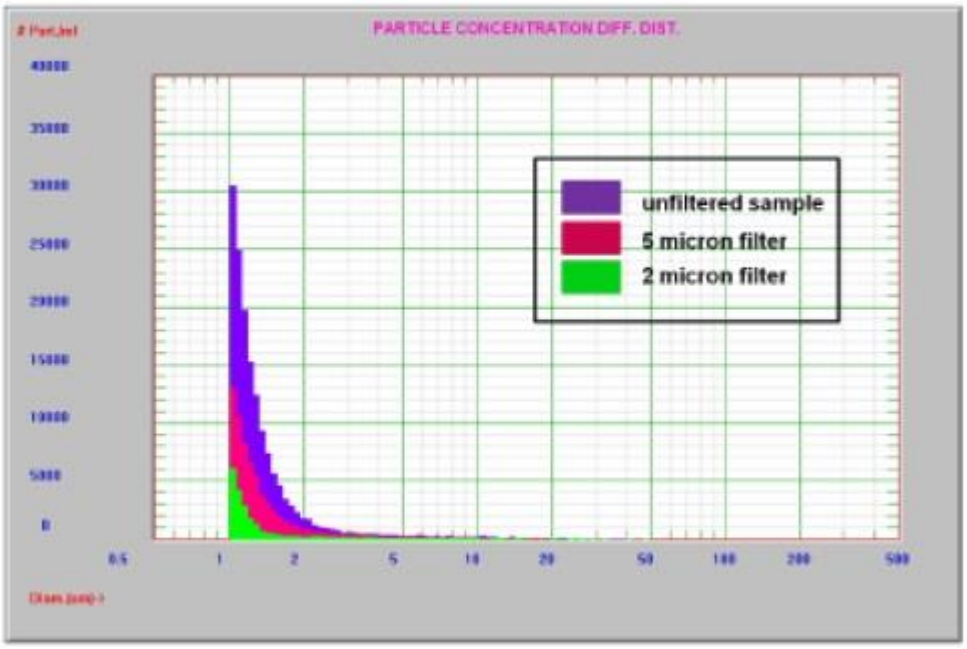

图 5：喷墨过滤的作用

结论

AccuSizer 780 在量化油墨中大粒子粒度和浓度方面是很理想的系统。本文研究了搅拌和过滤的作用，然而，该系统还可以作为一般的质量控制工具，以及研究最佳工艺条件的工艺研发工具。我们还可以根据应用、需求的不同从多种传感器和配置中选择。

Particle Sizing Systems（PSS）

8203 Kristel Circle, New Port Richey, FL 34668

Phone: 727•846•0866 | Fax: 727•846•0865

Website: www.pssnicomp.com

E-mail: sales@pssnicomp.com