HORIBA

Application Note

Measuring Size and Shape of Phosphates

AN276

Measuring Size and Shape of Phosphates on the Analysette 28

Introduction

Fertilizers are an integral part of farming, adding nutrients important for plant development to the soil. Since soils can be lacking in specific nutrients, fertilizers can be tailored to specific crop and field needs.

Phosphates, nitrates and potash are common parts of most fertilizers, containing the three main elements needed for plant growth. Balancing this mixture is important, as different plants require different nutrients to form flowers, leaves, stems, roots or fruits. Size and shape information can help determine the speed at which these nutrients can break down, how homogonous the mixture is and many other qualities.

In this application note, a mixture of diammonium phosphate and monoammonium phosphate [$(NH_4)_2HPO_4$ & $(NH_4)H_2PO_4$] was tested on the Analysette 28, a dynamic image analyzer.

Figure 1. Phosphate sample run on the Analysette 28.

ANALYSETTE 28 ImageSizer

Analytical Test Method

Set the Basic Measurement Conditions

- Sample Information:
  - Sample Name: Phosphate
  - Lens: 0.350x Magnification

Procedure for Size Measurements

1. Split the sample to get a representative amount.

2. Create an SOP with the following conditions:

   Camera Gain: 19
   Camera Flash: 1.66
   Threshold: 140
   Feeder Speed: 12
   Pre-Feed Speed: 15
   Stop Condition: 1000 Empty Images

3. Load sample into the hopper and raise hopper 1.5x the height of the largest particles.

4. Run the SOP.

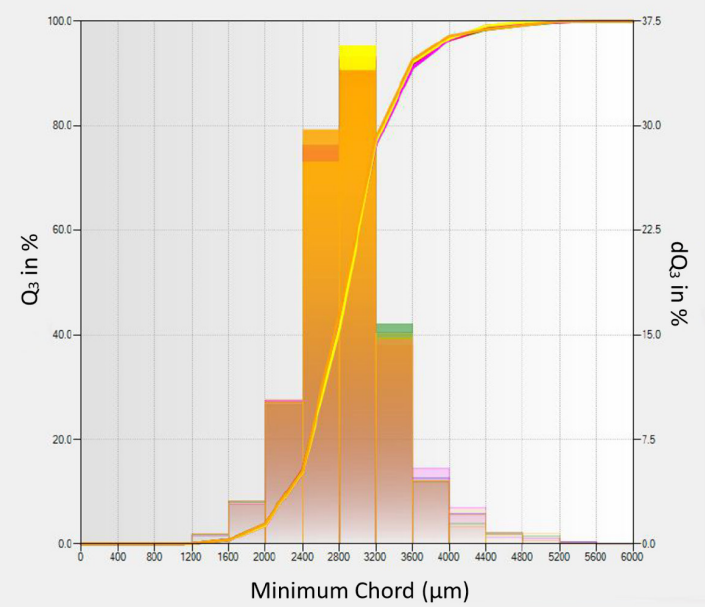

Figure 2. Histogram of Minimum chord in micron, six runs overlayed.

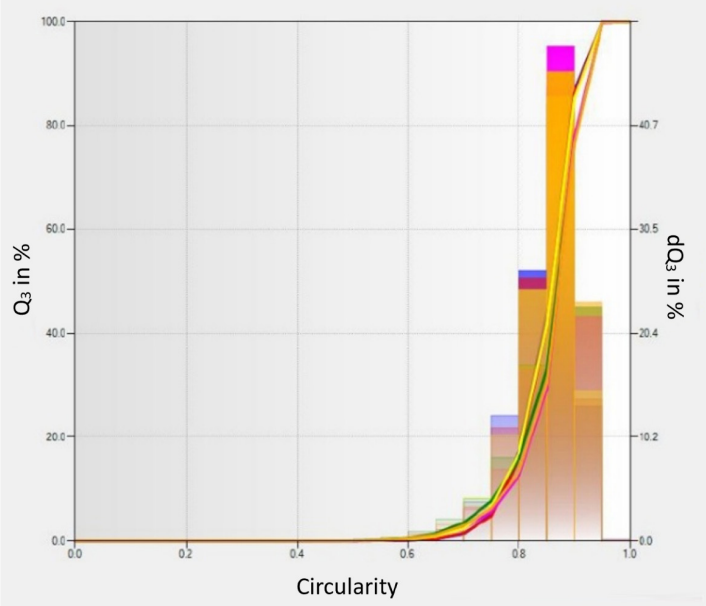

Figure 3. Histogram of Circularity, six runs overlayed.

File Name	D10	D50	D90
Phosphate Run 1	2296	2878	3505
Phosphate Run 2	2276	2878	3500
Phosphate Run 3	2281	2872	3497
Phosphate Run 4	2301	2875	3539
Phosphate Run 5	2295	2884	3517
Phosphate Run 6	2284	2863	3485
Average	2289	2875	3507
Std. Dev.	9.87	7.10	18.77
CV (%)	0.43	0.25	0.54

Table 1: Minimum chord in microns measured values.

File Name	X10	X50	X90
Phosphate Run 1	0.7754	0.8583	0.9040
Phosphate Run 2	0.7793	0.8614	0.9046
Phosphate Run 3	0.7689	0.8754	0.9108
Phosphate Run 4	0.7844	0.8770	0.9107
Phosphate Run 5	0.7714	0.8620	0.9056
Phosphate Run 6	0.7803	0.8778	0.9113
Average	0.7766	0.8687	0.9078
Std. Dev.	0.0058	0.0090	0.0034
CV (%)	0.7499	1.0334	0.3789

Table 2: Circularity measured values.

Results

The phosphate sample was run six times, and the data is shown in **Table 1 (Size)** and **Table 2 (Shape)**. While size was broad, the circularity was quite uniform indicating that whatever the size, the shape stayed round.

Conclusion

Measuring phosphates on the Analysette 28 shows great repeatability. It's a great way to get accurate shape and size information.