HORIBA

Contamination in Chemical Manufacturing: Implications for Product Integrity and Process Efficiency

Issues and Challenges

In the chemical industry, controlling product quality and purity is crucial for safety and economic performance. Contamination the unwanted presence of one product in another can alter product properties and pose risks to operators, users, and the environment. It also leads to production stoppages, high cleaning costs, loss of raw materials and regulatory and commercial consequences (non-compliance, recalls, damage to reputation). Preventing contamination is therefore strategic for ensuring process reliability and competitiveness. Diffraction is particularly suitable for detecting contamination because it allows rapid identification. Even in small quantities, a contaminant generates a distinct diffraction pattern, which facilitates its detection and characterisation without the need for complex preparation. This technique is therefore a reliable tool for ensuring product purity and quality control.

Example

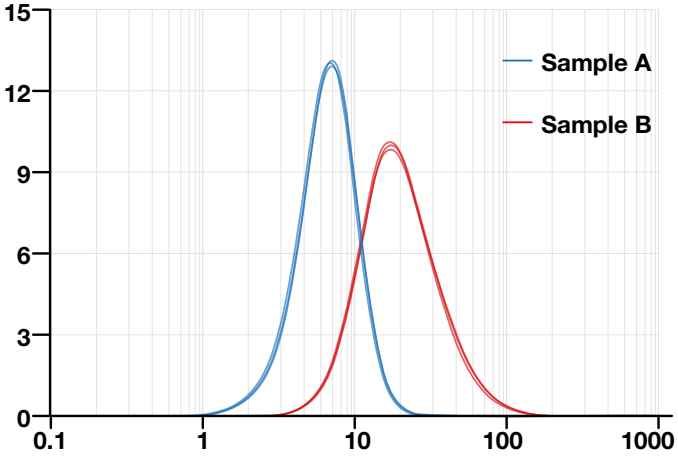
Here we designate the samples as Sample A and Sample B.

- Sample A is a technical additive.
- Sample B is a mineral filler.

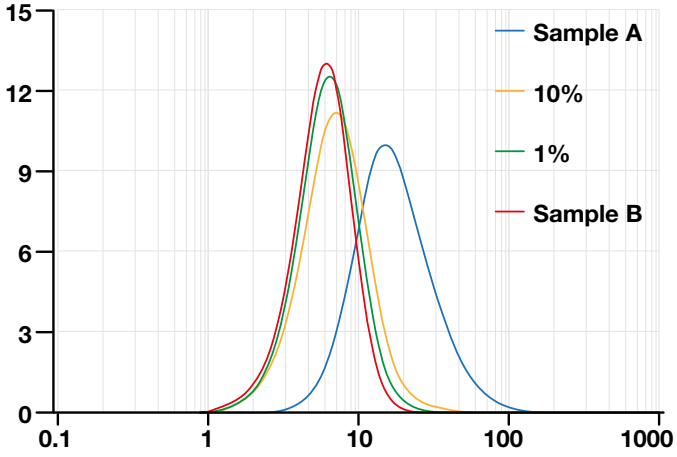
In this application note, two samples with distinct particle size distributions were selected. These were blended at controlled proportions and then analyzed in order to monitor the evolution of the particle size distribution as a function of the introduced contamination level. This approach makes it possible to assess the sensitivity of the method and to determine the minimum detectable threshold of contamination between the two samples.

These two products are widely used in various chemical industries such as plastics, paints & coatings, and rubber & elastomers. The table below summarizes their typical uses and the associated contamination risks when the two products are mixed.

Field	Use of Sample A	Use of Sample B	Risk if A → B	Risk if B → A
Paints / Coatings	Matting agent, mechanical reinforcement, scratch resistance	White filler/opacifier, cost reduction, increased opacity	Unwanted loss of gloss (more matte), hard spots, higher cost, aesthetic rejection	Loss of hardness/ scratch resistance, gloss/matte variability, product non-compliance
Rubber / Elastomers	Flame retardant, thermal resistance, reduced smoke	Cost-effective filler, rigidity, volume (e.g. soles, hoses)	Segregation/equipment damage, altered mechanical properties, unnecessary cost	Reduced flame retardancy leading to failed fire tests, regulatory risk
PVC / Plastics	Flame retardant additive, enhanced fire resistance, mechanical reinforcement	Main filler for rigidity, opacity, cost reduction, rheology	Increased wear on extruders (abrasion), surface defects (hard spots), higher cost, customer rejection	Reduced flame retardancy leading to failed fire tests, regulatory risk (e.g. cables, construction)



Particle Size Distributions – Sample A (red) vs Sample B (blue), 3 repeats



Particle Size Distributions of "Contaminated" Samples at Various Percentages

The analysis of the graphical distributions shows that a difference compared to the pure product (Sample B) remains visible up to a contamination level of 1%. This trend is confirmed by comparing the characteristic values D10, D50, and D90 (see table).

Samples	D(v.0.1)	D(v.0.5)	D(v.0.9)	Mode Size	Mean Size
Sample B	3.01 µm	5.51 µm	9.20 µm	5.51 µm	5.87 µm
1%	3.23 µm	5.92 µm	10.22 µm	6.26 µm	6.44 µm
10%	3.38 µm	6.57 µm	12.19 µm	6.32 µm	7.48 µm
Sample A	7.89 µm	15.45 µm	34.25 µm	14.18 µm	19.03 µm

Conclusion

With this application note, we have demonstrated that the Partica LA-960V2 is capable of effectively detecting cross-contamination between two products, even at very low levels. Its advanced laser scattering technology allows rapid identification (in less than 60 seconds) of any deviation or anomaly in particle size distribution, with high accuracy and reproducibility.

This sensitivity makes it a particularly suitable tool for quality control and contamination risk management in the chemical industry.

info.sci@horiba.com **www.horiba.com/scientific**

USA:	+1 732 494 8660	**Italy:**	+39 06 51 59 22 1	**Singapore:**	+65 (6) 745-8300
France:	+33 (0)1 69 74 72 00	**Japan:**	+81(75)313-8121	**Taiwan:**	+886 3 5600606
Germany:	+49 (0) 6172 1396 0	**China:**	+86 (0)21 6289 6060	**Brazil:**	+55 (0)11 2923 5400
UK:	+44 (0)1604 542 500	**India:**	+91 (80) 4127 3637	**Other:**	+33 (0)1 69 74 72 00