


Chapter 9

Trends, Applications, and Factors of Wet Sieving as a Particle Size Analysis Technique: Insights on Mineral Processing and Mechanical Alloying

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ABSTRACT

In mineral processing, particle size is an important factor to consider since it affects plant design and performance, which later determines the plant's economic return. A certain particle size above and below the mine's optimal size range can adversely influence the recovery of valuable minerals. Particle size analysis is crucial in mechanical alloying controlling alloy composition and homogeneity of the mixture, affecting milling kinetics, reducing contamination, optimizing the milling process, and predicting properties. This chapter includes the understanding of particle size distribution, which helps researchers to tailor the alloying process for specific applications. The trend has been the wet-sieving analysis as a particle size analysis tool for the past 25 years. It provides an overview of different industries where the particle size analysis is used and associated end-users. The chapter also reports on the variables and principles governing factors that affect wet sieving analysis and the challenges that can give misleading and erroneous particle size distribution results.

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1. INTRODUCTION

Particle size analysis frequently involves the use of sieves, especially for granular materials. Particle size analysis has become more accurate and effective thanks to several trends and developments in sieving methods and technology during the past 25 years. The key trends of sieving that remain fundamental and widely used in particle size analysis techniques; are advancements in automation, sieve design, standardization, instrumentation, software integration, and environmental considerations (Sanchez-Suarez et al., 2022). These have contributed to improving the accuracy, efficiency, and sustainability of sieving over the past 25 years.

Particle size analysis, including sieving, plays a vital role in various industries, such as pharmaceuticals, construction, and mining. In recent years, there has been a growing emphasis on standardization and adherence to regulations for particle size analysis. Organizations like the International Organization for Standardization (ISO) and the American Society for Testing and Materials (ASTM) have developed guidelines and standards to ensure consistency and comparability of sieving results across different laboratories and industries (American Standards & Test Methods, 2017). Data analysis and software integration on sieving technique has recently become more interesting. With the rise of data analysis and automation, software solutions for sieving have evolved. Dedicated software programs can now integrate with sieving equipment, enabling real-time monitoring, data capture, and analysis (Sanchez-Suarez et al., 2022). These software solutions offer features like data visualization, automated calculations, and customizable reporting, making the interpretation and sharing of sieve analysis results more efficient. Additionally, in recent years, there has been an increased focus on sustainability and reducing environmental impact. This trend has influenced particle size analysis techniques, including sieving. Efforts have been made to minimize waste generated during the sieving process, optimize the energy consumption of automated sieve shakers, and explore environmentally friendly sieve materials (Bertula, 2022).

The study conducted by Liu, (2009) demonstrated that parameters such as material type, milling process, moisture content, tapping, sieving method, sieving time and their interactions might all exert an impact on sieving efficiency and performance. The most important parameter was tapping, followed by sieving time, sieving method, milling process, material type and lastly moisture content. It was reported that the reverse sieving approach showed an improved PSD curve as opposed to the conventional stacked sieve method. The improvement was reported in terms of increased sieving rates, minimized sieve loss and increased final fraction mass under similar conditions of investigation. The advantage of bigger particles was linked to the observed difference in sieving efficiency, performance, and loss between the

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