Chapter 1
Comparison of Wet and Dry Milling

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ABSTRACT

This chapter discusses the distinguishing features between wet and dry ball milling processes used in industries. Wet milling and dry milling are the two categories under which industrial milling are most frequently employed in the manufacturing sector. It is important to comprehend the fundamentals in order to understand the differences between the two and the difficulties associated with the milling process. The process of milling involves applying various mechanical forces, such as grinding media, pegs, rods, pebbles, and screens to break down particles. The components of the mill work on the mixture's solids to separate or crush them, further reducing their size, as the material is pumped through it.

1. INTRODUCTION

Milling processes are of utmost importance in diverse industries, serving as essential operations for the reduction of particle size and the processing of materials. Wet

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milling and dry milling are two widely investigated and utilised milling techniques within the field. Wet milling is characterised by the utilisation of a liquid medium throughout the milling procedure, whereas dry milling is predicated on the absence of a liquid medium (Loh et al., 2015). The techniques provide notable benefits and pose distinct difficulties, contingent upon the application and intended result. The examination of wet and dry milling methods is of considerable importance owing to its implications for the efficiency of particle size reduction, the quality of the resulting product, the consumption of energy, and the impact on the environment (Cañellas, Al-Rifai, Padrela, Tajber, Khamiakova, Otava, & Geertman, 2023). Gaining a comprehensive understanding of the distinctive attributes and efficacy of each approach empowers researchers, engineers, and industry practitioners to make judicious choices when it comes to selecting the optimal milling method that aligns with their particular requirements.Milling is an essential procedure employed across various industries, encompassing pharmaceuticals, food processing, cosmetics, and chemical manufacturing. The process entails the reduction in size of solid materials, including grains, ores, and particles, in order to achieve the desired characteristics of the final product. Wet and dry milling are two distinct methodologies utilised in this process, each possessing its own distinct advantages and limitations (Protonotariou et al., 2021). Wet milling is a size reduction technique that involves the utilisation of a liquid medium, commonly water or a solvent, in the milling process. The substance intended for milling is submerged in a liquid medium, facilitating the creation of a mixture with a semi-liquid consistency. On the other hand, dry milling entails the utilisation of solid-state procedures, wherein the absence of any liquid is observed, and the substance is processed in its dehydrated state. The selection between wet and dry milling is contingent upon various factors, including the desired particle size, attributes of the product, and the inherent properties of the material undergoing processing. Both methods possess distinct advantages and limitations, underscoring the importance of comprehending their disparities and assessing their suitability for particular milling needs (Nykamp et al., 2002).

1.1 Brief Overview of Milling Processes and Their Significance in Various Industries

The history of wet and dry milling can be traced back to ancient times, as both methods have been used for processing various types of materials. Here's a brief overview of the history of wet and dry milling (Figure.1).

The earliest evidence of milling dates back to the Stone Age, where stone tools were used to grind grains and other food materials. In this primitive form of milling, the grains were crushed and ground between two stones, creating a coarse powder or paste. In ancient civilizations like Egypt and Greece, advancements in milling