Wood pellet milling tests in a suspension-fired power plant

This paper investigates the milling behavior of two industrial wood pellet qualities (designated I1 and I2 as per ISO 17225-2:2014) in large-scale coal roller mills, each equipped with a dynamic classifier. The purpose of the study was to test if pellet comminution and subsequent particle classification (i.e., the classifier cut size) are affected by the internal pellet particle size distribution obtained after pellet disintegration in hot water. Furthermore, optimal conditions for comminuting pellets were identified. The milling behavior was assessed by determining the specific grinding energy consumption and the differential mill pressure. The size and shape of comminuted pellets sampled from burner pipes were analyzed by dynamic image analysis and sieve analysis, respectively. The results showed that the internal pellet particle size distribution affected both the milling behavior and the classifier cut size. I2 pellets with coarser internal particles than I1 pellets required more energy for milling, led to a higher mill pressure drop and showed a larger classifier cut size. Comminuted pellet particles sampled from burner pipes were notably finer than internal pellet (feed) particles. At similar mill-classifier conditions, characteristic particle sizes of 0.50mm for comminuted I1 pellets (compared to 0.83mm for material within I1 pellets) and of 0.56mm for comminuted I2 pellets (compared to 1.09mm for material within I2 pellets), respectively, were obtained. Pellet comminution at lower mill loads and lower primary airflow rates reduced the mill power consumption, the mill pressure drop, and the classifier cut size. However, this was at the expense of a higher specific grinding energy consumption. Derived 2D shape parameters for comminuted and internal pellet particles were similar. Mill operating changes had a negligible effect on the original elongated wood particle shape. To achieve the desired comminuted product fineness (i.e., the classifier cut size) with lower specific grinding energy consumption, power plant operators need to choose pellets with a finer internal particle size distribution.