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13. IMPACT OF THE SIZE DISTRIBUTION OF SEMOLINA IN THE STRUCTURATION OF WHEAT POWDER BY WET AGGLOMERATION

Bettina Bellocq, Agnès Duri, Bernard Cuq & Thierry Ruiz

UMR IATE 1208 CIRAD/INRA/Montpellier SupAgro/Université de Montpellier
2 Place Pierre Viala, 34060 Montpellier cedex 5, France.
E-mail: bellocq@supagro.inra.fr

The control of the wet agglomeration processes of powders depends on the combined contribution of native powders characteristics, energy input, and wetting liquid binder. The objective of this work is to specifically investigate the contribution of the size distribution (d_{50} and span) of the native particles, on the dimensional and structural characteristics of the agglomerates. Experiments are performed with native semolina particles. The agglomeration process is conducted using water as liquid binder. Several fractions of native semolina with contrasted dimensional properties (d_{50} and span) are prepared by a sieving procedure. The wet granulation is processed under specific conditions using a low shear granulator at constant blade speed, product load, liquid spraying condition (constant dimensionless spray flux) and residence time. The agglomerates properties are evaluated by the distribution of the measured values of the size, water content and compactness. The mean values and their fluctuations are both taken into account to describe the agglomeration mechanisms.

Whatever the size distribution of the native powder, the mechanisms involved in the agglomeration process are the same but with different importances especially the breakage of agglomerates. We observed specific effects of the span and the median diameter of native powders on the size distribution of the agglomerates. Using small native particles ($d_{50} < 250 \mu\text{m}$) improves the homogeneity of the size distribution of the agglomerate bed. Using slightly dispersed native particles (span < 1.0) leads to a better uniformity on the size distribution. We demonstrate that the conditions to obtain a population of agglomerates with a narrow size distribution depend on the ratio between the water droplet diameter ($d_{50\text{drop}} \sim 250 \mu\text{m}$), and the median diameter of the native particles. This diameter ratio is considered as a process parameter. We propose to build a modified dimensionless spray flux number by incorporating this diameter ratio. The nucleation step is specifically described by this new dimensionless number.