Summary

In modern agriculture, the use of specialized and appropriately selected fertilizers is becoming increasingly important to enhance agricultural production efficiency while maintaining the quality of crops and soil. These fertilizers should be characterized by high nutrient concentration and high availability for plants. The literature describes the use of surfactants in liquid fertilizers and the high efficacy of preventive foliar fertilization. Additionally, attention should be given to the significant effect of fertilizing crops with agents containing high concentrations of Zn and the high availability of this important micronutrient in agricultural products.

Granulated chelates are innovative fertilizers that are highly effective and versatile, providing plants with the best initial effect. The final properties of the granulate are influenced by the method of preparation and the substances used. Fluidised Bed Spray Granulation (FBSG) is an important industrial process for producing solid granules from suspensions or solutions. Initially, solid particles are fluidise by an upward gas stream. Then, the fluidsed bed is sprayed with a suspension or solution, which deposits on the particles. Under appropriate conditions, i.e., gas humidity and temperature, the liquid phase evaporates, forming a new solid layer on the particles. The particles vary in size, resulting in a particle size distribution (PSD). Fluidised bed spray granulation enables the production of particles with desired characteristics, including PSD, density, or dust content.

For large-scale production, fluidised bed spray granulation operates continuously. Here, besides the desired steady-state action, instabilities such as nonlinear oscillations can occur, depending on specific process conditions. The diameters of the obtained granules, their size range, and the final production costs of the fertilizer are of great importance.

The dissertation describes the process of granulation using the agglomeration of Zn(II)IDHA in a fluidised bed with an aqueous solution of this substance with high dry matter content. The work focuses on experimental research to select the most favorable process conditions. The influence of selected factors on the granules obtained in a continuous FBSG process for chelated fertilizers for foliar application was also examined. The impact of adding a surfactant to the solution sprayed into the bed and perturbing operational parameters on PSD and granule morphology was investigated. The experiments were complemented by calculations based on the Population Balance Equation (PBE). It was shown that increasing

the milling speed contributes to a slight increase in dust but does not disrupt the regular agglomeration process in the long term. The calculation results confirm that despite the complexity of the process, its description using PBE is feasible. Based on the conducted experiments, the parameters of the studied process were selected to achieve a so-called steady-state during the production of Zn(II)IDHA, ready for industrial scale implementation.