Challenges, Solutions and Opportunities within Pharmaceutical API Development: Overview and Case Study

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The API (Active Pharmaceutical Ingredient) development landscape encompasses a wide range of processes, which all need to be optimized to ensure that the right particles are delivered for effective drug product formulation. This is especially prudent in a highly regulated environment where all aspects of development must be understood and controlled to very tight standards. The API particle forming step can take place as part of a chemical synthesis stage or as a separate stage in itself, to try and gain greater control over the final particle properties, if required. Regardless of the route taken, the particle formation stage is a complex process that requires a holistic understanding of fundamental crystallization and particle processing science, from solubility and nucleation to particle size control and isolation/drying routes. Each of these factors constitute challenges and opportunities during API development. Here, common challenges within API particle development are presented, with solutions and opportunities discussed, with particular focus on particle size control. A case study of a development API, is presented, detailing how requirements for a drug product can dictate the properties required of API particle size and how particle size reduction processes can be developed at lab-scale and implemented at plant-scale to meet these requirements.