Applying the Fundamentals

PSRI and Pharmaceutical Processes

PSRI has over 200 years of experience in design, development, and troubleshooting with over 250 reviewed publications in granular fluid systems including gas-solid, gas-liquid and gas-liquid-solid process. Understanding secondary effects such as agglomeration, segregation, attrition, structural changes, protein unfolding potentials are paramount in maintaining desired chemical and physical stabilities. Thus, scale-up must consider factors such as temperature, pressure, shear, air-water interfaces, etc.

PSRI Particulate Solid Research, Inc.

Applying the Fundamentals

Challenges in Process Development of Pharmaceutical Products

Regulatory body's limit compelling justifications for changes in the process flow and design in pharmaceutical manufacturing. Even scale-up from batch to continuous processing can involve insurmountable obstacles in engineering, economics and regulation compliance. No one wants to spend money on the perceived financial gains even if they are significant because the drug performance has to be reconfirmed.

A fundamental understanding of particle properties and behavior is paramount in a fast and effective scale-up effort. This is PSRI's specialty. We have over 45 years of experience in doing just that. PSRI understands the value and benefits of fast and effective scale-up; even with going from a batch process that is developed in the laboratory to a commercial process using only limited batch runs on each scale. PSRI knows that process flow and design has to be envisioned and planned from day one of the process development of the new molecule. It has to be completed before the activity enters the clinical trial phase. If not done by then the regulatory requirements will discourage changes and innovation.

Thus, considerations of process flow and design need to focus on both chemical and physical degradation. How product quality and structural changes, e.g. tablet uniformity and protein stability, are affected by interfacial areas, mixing, stresses, temperature and pressure, humidity and even time is paramount in successful scale-ups. PSRI is well suited for such understanding. We study nuances in powder, granular, granular-fluid and complex fluid hydrodynamics on production-scale equipment along with state-of-the-art modeling tools. The result is a clear understanding of the fundamentals that can be successfully applied to a production concept.

Our state-of-the-art research facility in Chicago, IL provides a platform to get these understandings on a scale relevant to commercialization. Agglomeration, attrition, segregation, mixing, consolidations, and shear are quantified such that design parameters are for relevant scales. Otherwise, the interfacial area does not relate to wall surfaces, segregation and mixing are not comparable on a relatable time scale, shear is over-predicted, agglomeration and attrition happen on a different time scale, etc. Indeed, such experiments are often irrelevant when done on small laboratory scale units.

At PSRI, we know size matters. It affects development time, product quality and production goals. We have seen it in the petroleum, chemical, plastics, mining, and semiconductor industries and we know how to leverage such learnings towards pharmaceutical challenges. Our long history collaborating with various fields dictated by many different regulatory bodies allows for out-of-the-box solutions that can be successfully leveraged within the pharmaceutical regulatory directive.

Applying the Fundamentals

PSRI Process Development Experts

Dr. S.B. Reddy Karri, Consulting Director: Reddy has 28 years experience in particle technology and fluidization. He has worked on FCC technology, cokers, polyolefins, methanol to olefins, maleic anhydride, acrylonitrile, TiO_2, polycrystalline silica, gasification, pyrolysis, sulfur capture, CO2 capture, biomass and radioactive materials.

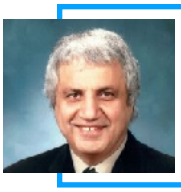
Dr. Ted Knowlton, Fellow: Ted has 46 years experience in particle technology. He has worked on FCC technology, cokers, polyolefin, MTO, maleic anhydride, acrylonitrile, TiO_2, polycrystalline silica, gasification, pyrolysis, sulfur capture, CO2 capture, and mining. He has developed well-known processes such as HYGAS, U-GAS, PEATGAS, RENUGAS, HYTORT, PFH and is the developer of the L-valve.

Mr. John Findlay, Technical Consultant: John has 34 years of experience in particle technology and fluidization. He has worked on FCC technology, cokers, polyolefin, TiO2, coal gasification, pyrolysis, sulfur capture, CO_2 capture, and biomass.

Dr. Ray Cocco, President and CEO: Ray has 27 years experience in reactor engineering, modeling, fluidization, and particle technology. He has worked on ceramic processing, oxydehydrogenation, pharmaceutical hydrogenation, catalytic oxidation, hydrogenation, hydrodesulfurization, composite materials, biomass, chemical looping, polyolefin, chlorination and oxychlorination.

Dr. Jeffrey Smith, Technical Consultant: Jeff has 20 years of experience in reactor engineering and fluidization. He has worked on FCC technology, cokers, methanol to olefins, gasification, pyrolysis, and methyl chloride and polydimethylsiloxane.

Dr. Ben Freireich, Technical Director: Ben has 8 years of experience in particle technology and has recently been listed as one of AIChE's 35 under 35. He as worked on a wide range of reactor engineering and solids processing problems including catalyst deactivation and attrition, bin design, fluidized beds, pneumatic conveying, mixing and blending, segregating systems, size reduction, etc.



Dr. Manuk Colakyan, Technical Consultant: Manuk has 30 years experience in reactor engineering and solids processing. Notably, he was instrumental in the R&D efforts for the commercialization of the Unipol process. He also has experience with multiphase flow systems, heat and mass transfer and super critical fluids.

Dr. Ulrich Muschelknautz, Technical Consultant: Ulrich has 27 years experience in particle technology with emphasis on cyclone design and optimization as applied to the energy and chemical sectors. Of late, he has been involved in the R&D efforts for the next generation of axial separators.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