Complete a PhD being a member in the IPROCOM Project

My name is Kitti Csordás. I finished my graduation after 5 meaningful years in June, 2013 in University of Szeged, Faculty of Pharmacy. I am working as a PhD student in the Heinrich-Heine University in Düsseldorf, Germany since 1 year.

I had an internship as pharmacy student over the last 4 semesters in the Institute of Pharmaceutical Technology. I also wrote my graduation thesis ("Application of Quality by Design principles developing lysozyme contained solid dosage forms") in this Institute. My supervisors were Dr. Tamás Sovány and Dr. Ildikó Csóka & Dr. Anita Kovács from the Institute of Pharmaceutical Regulation. Professor Dr. Klára Hódi also accompanied my studies. In this time, I turned to be highly interested in making PhD in abroad. The Institute of Pharmaceutical Technology has a fruitful collaboration with Professor Dr. Dr.h.c. Peter Kleinebudde from the Institute of Pharmaceutics and Biopharmaceutics, HHUD, Germany since 12 years. Due to this well-functioning correspondence, I had the chance to apply for and get a doctorate position in the Institute of Pharmaceutics and Biopharmaceutics within the framework of the IPROCOM Project funded by the European Commission.

IPROCOM is a multidisciplinary and intersectoral consortium aimed at development of *in silico* process models and at understanding the fundamental mechanisms of particulate manufacturing processes involving roll compaction. The development of in silico process is based on the properties of individual particles (intermediate products, ribbons or granules and final products, tablets or pellets) with identified process conditions and formulations. This will be carried forward collaborating with academic and industrial partners that are involved in the IPROCOM Project. The Project offered 12 Early Stage Researcher (ESR) positions and 3 Experienced Researcher (ER) positions. These 15 fellows are divided in 3 work packages (WP) and in 4 strands. Work package 1 (WP1) is process understanding that fulfills the experimental part of the project investigating the different powder, particle, ribbon and granule properties, roll compactor designs, scale-up rules in roller compaction. Its main aim is to fill the current knowledge gap on how material properties of single particles and process conditions govern the product properties. Work package 2 (WP2) is multi-scale modelling using different model

techniques: Discrete Element Method (DEM) and Finite Element Method (FEM) to predict the properties of final products based on the individual particle properties. The experimental data of work package 1 will be used as input and as far as possible for validation for work package 2. Work package 3 (WP3) is intelligent modelling, that main objective is to develop computational intelligence (CI) models for particulate product manufacturing. A robust bio-inspired CI platform will be developed using novel adaptive algorithms and data structures to predict the product quality. The 4 strands are mixing (S1), roll compaction (S2), milling (S3) and die compaction (S4). Each strand includes researchers working on experimental (WP1), numerical (WP2) and CI (WP3) modelling (1).

Roller compaction is a continuous dry-granulation process, which is widely used in the pharmaceutical, chemical and mineral industry. This process has several advantages: it improves poor powder flow properties, increases the bulk density and compressibility, reduces the loss of material during production (controls dust) and ensures the uniformity of the formulation. Using roller compaction no liquid binder is requested and, thus the drying stage can be avoided, resulting in a time and cost-effective process. Furthermore, roller compaction is attractive for moisture and or heat-sensitive materials. Overall, the material should be isotropic, frictional, cohesive and compressible (2). Despite of the extensive use of roller compaction, the insufficient process understanding causes qualitative problems in the continuous ribbon production. One of the main problems is the non-uniform density distribution. So far, there is no established method available to determine the density distribution of the ribbons. In previous studies, it was found, that the heterogeneous density distribution (heterogeneous porosity) leads to localized ribbon strength, that causes differences in the particle size distribution and strength of the granules (3).

My thesis is “Impact of powder properties and system design on roller compaction” belongs to WP1 and to S2. I am investigating how the different system designs influence the ribbon and granule properties using the unique chance offered by IPROCOM. I am working with small-scale roll compactors, in this time with the Minipactor® (Gerteis Maschinen + Prozessengineering AG, Jona, Switzerland) in Düsseldorf, Germany using Microcrystalline Cellulose Avicel PH101 (FMC BioPolymer, USA) and Mannitol Pearlitol 200 SD (Roquette, USA). As a part of the project, I will spend few weeks as secondments in many companies to have a sight into their everyday lives, may turn to be more professional in the scientific field and to work with different types of roll compactors, for example with the AlexanderWerk BP 120® and with the VectorFreund TFC Lab Micro® roll compactor. I am going to spend my first secondment in September and October at AstraZeneca, in Macclesfield, United Kingdom.

I feel very lucky and happy to be a member in such a great and international project that teaches me how to work with scientists from different scientific fields. So, participating in the IPROCOM Project will help me to become a better person in the scientific and private life. I would like to thank to my supervisor, Prof. Dr. Dr.h.c. Peter Kleinebudde, who is supporting me so

much every day in my PhD. To achieve my progress in the first year of my PhD was possible only with his advices and encouragement.

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Literature

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