IFPRI Project Abstract

A multiscale study of powder reconstitution phenomena

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Project Objective:

Organic and biologically-derived materials in powder form are involved in the manufacturing of many products available in the industry (e.g., cosmetics, food, pharmaceutics). Their reconstitution is of upmost importance for the industry considering that most powdered ingredients are dissolved or infused before use. Therefore, deeper mechanistic understanding and global approaches are needed regarding the great variety of powders industrially available. Also, fundamental understanding enabling improvement of the reconstitution of these powders is still lacking with a focus on the particle surface.

Approach:

This three-year project (plus one due to COVID) approach aims at:
(1) Developing a reconstituability index to draw a predictive criterion for the classification of unknown industrial powders according to their reconstitution behavior from the knowledge of their physical and chemical characteristics.
(2) Bringing new knowledge in the reconstituability of industrial powders with a focus on the particle surface.

Recent Results (year#3):

A semi-empirical model able to describe the kinetics of reconstitution by particle size monitoring was developed and made it possible to better understand the impact of the physicochemical properties of the powders on the reconstitution steps. Finally, a predictive model of the reconstitution time of the powders under the reference conditions used in the experiments adapted during the first year was developed using the most influential physicochemical properties.

Next Steps (year#4):

Due to COVID lockdown, a 4th year was financed by IFPRI. The PhD student (Tristan Fournaise) will defend his thesis in July 2022 and a post doc was recruited in order to focus the year 4 on the following parts:
(1) Development of a method to discriminate powder components depending of their location within particle
(2) Deciphering the segregation of components in particles in order to correlate reconstitution properties and surface composition.
(3) Identify molecules segregation and links with reconstitution in various powders studied in year 1