



# IFPRI Project Abstract

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## **A multi-scale 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, pharmaceuticals). Their reconstitution is of utmost 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.

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### ***Approach:***

This project approach aims at:

- (1) Developing a reconstitutability 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.
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### ***Recent Results:***

(year#1) Reconstitution kinetics were monitored simultaneously for fifty industrial powders in order to be able to develop predictive models. Statistical correlations between the numerous powder characteristics and their reconstitutability were established. Powders were classified into four groups depending on their wetting and reconstitution ability (i.e. Green group: short wetting and reconstitution times, Yellow group: long wetting time and short reconstitution time, Orange group: short wetting time and long reconstitution time, Red group: long wetting and reconstitution times).

(year#2) It is well known that some reconstitution steps strongly depend on particle surface. Poorly wettable particles were coated with various sugars in order to establish correlations between powder reconstitution behavior and surface properties (i.e. hydrophobicity/hydrophilicity, hardness).

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### ***Next Steps:***

The work of year 2 is ongoing. Various formulations will be done by coating whey powder with sugars (i.e. lactose, sucrose, fructose, glucose and saccharose). These sugars present different wetting behavior, ability to cover the particle surface, chain length, glass transition temperature... These new powders are characterized with a focus on the surface: stiffness, hydrophilicity, rugosity. The minimal sugar proportion necessary to improve whey powder wettability will be determined for each sugar and compared.

From year 3, we will start soon to work on empirical models able to predict reconstitution times as well as the definition of a reconstitutability index reflecting powder reconstitution behavior independently from reconstitution conditions in agitated vessels.

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