Washing powder: Does each component of detergent powder dissolve differently during the laundry cycle?

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1. Introduction

A growing amount of soluble materials (granules, tablets or pellets) are commonly used in daily life. The dissolution process of these materials is a complex sequence of physical and chemical transformations, however they sometimes happen simultaneously. This fact increases the difficulty of studying this phenomenon.

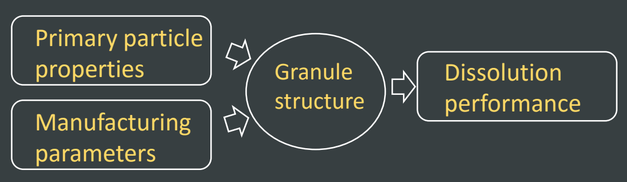

Fig. 1. Schematic of the parameters that determine macroscopic properties.

The main aim of this work is to study the role of granule structure (Fig. 1) in the dissolution behaviour of washing powder. This knowledge would allow us to design detergents with defined release components.

2. Methodology

Combining UV-Vis spectrophotometry and electrical conductivity experiments, the dissolution rate of different components of soluble materials can be measured. The release profile obtained by conductivity determines the dissolution rate of the inorganic salt while the binder dissolution is represented by the UV-Vis absorbance data.

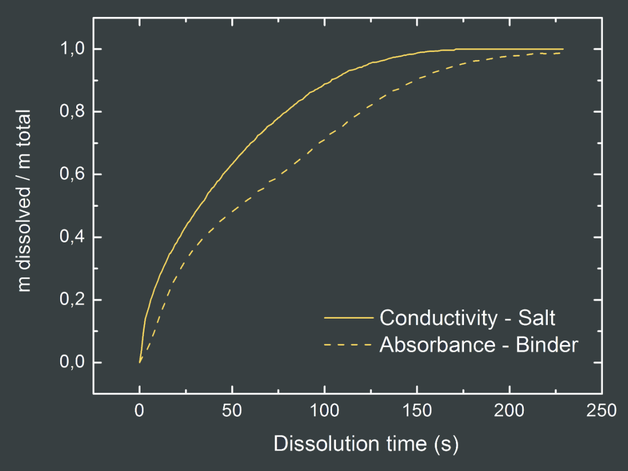

Fig. 2. Example of the dissolution profiles of both components.

The internal structure of the granule is visualised and analysed by X-ray tomography.

3. Results and discussion

Powders A and B with internal structure represented in Fig. 3 present completely different dissolution behaviours (Fig. 4). Soluble components that dissolve faster present higher effective diffusivities.

Fig 3. Salt (yellow) and binder (white) location in the granule of powder A and B, respectively.

The solids in the case of powder A dissolve clearly faster than the binder. This is logical as inorganic salts usually dissolve faster than binders. However, in powder B the diffusivity of both compounds is similar due to the fact that salt particles are surrounded by binder.

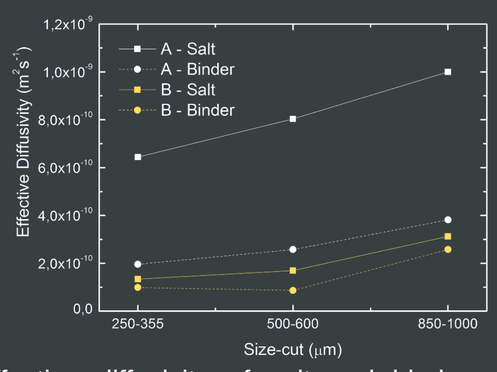

Fig 4. Effective diffusivity of salt and binder of both blown powders.

4. Conclusions

The dissolution performance of the two blown powders studied are completely different. The main reason of this difference is the fact that in powder B salt is granule structure, which determines the dissolution performance of the components.

The location of the components in a granule, porosity and primary particle size must be characterized to understand the structure role in macroscopic properties such as dissolution rate.