Powder impregnation and wetting of soluble coatings: two model problems to understand better powder dissolution

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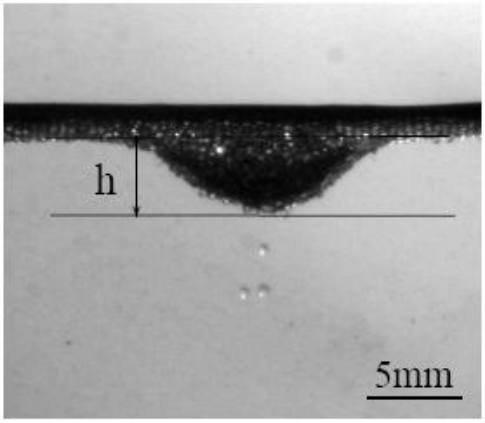
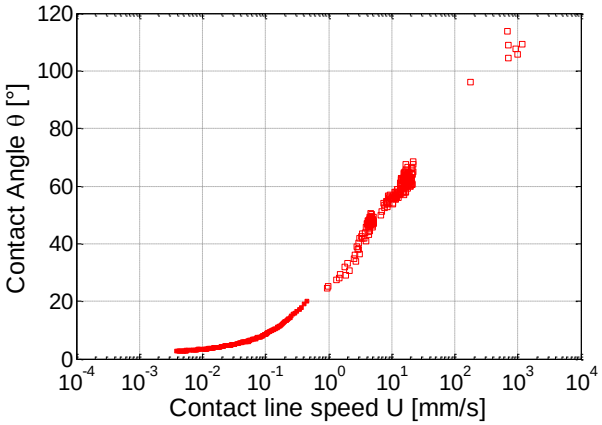
When a powder is poured onto the surface of a solvent, a complex interplay of several phenomena conditions its dissolution. The reconstitution of a beverage by pouring a soluble powder onto water represents a typical example.
We study this complex problem by simplifying it into several model problems.
We present first the study of the impregnation of non-soluble powder layers at the surface of a liquid [1], showing the existence of a critical contact angle below which spontaneous impregnation occurs. The effect of grain size distribution and forcing pressure is also discussed.
We then introduce a second study, characterizing the dynamic wetting of soluble coatings of maltodextrin [2]. The effect of contact line velocity, water content and coating thickness is discussed.
By combining the results of these two studies, we can derive an upper bound for the capillary impregnation rate in soluble powders, a phenomenon which conditions strongly their dissolution performance.





Left: Spontaneous impregnation of a floating island of non-soluble grains [1].
Right: Dynamic wetting angle of a water droplet on a maltodextrin thin coating [2].

References:

[1] P.S. Raux, H. Cockenpot, M. Ramaioli, D. Quéré and C. Clanet, Wicking in a powder, 2012, *Submitted to Langmuir*
[2] J.Dupas, M.Ramaioli, L.Forny, E.Verneuil, L.Talini and F.Lequeux, Fast spreading of volatile droplets onto a soluble coating: dynamic contact angle and coating hydration, 2012, *in prep. for Soft Matter*