

## Fact sheet Aw (water activity) in powders

**Even if measurement of water activity in powders seems to be an easy deal, interpretation can become quite tricky. The measurement itself is a question of pushing a few buttons and you are done, respectively you are thinking you're done.**

Even more so that sudden product texture changes, discoloration, oxidation, caking & clumping or hardening cannot be further explained. Water activity value and all other parameters are within specs.

Looking a bit closer to what is happening on material level. To create powders, drying steps are crucial but they are also the source of the problem. Once a product is dried, doesn't matter if the technology is spray or drum drying or even lyophilization, in the end, there is a dried grain (particle) of product, mainly un-equilibrated. Main reason: Capillary forces held back the water.

The inner side of this particle contains more water than the outside, so there is a risk that inner water activity is not equal to surface water activity.



But what are people doing if product's aw has to be measured? Correct, they take samples right after the drying process or once production has been finished. If water activity is measured at that point, you will get the surface aw of the particle but no chance to get the water from the inner side as it takes much longer till thermo-dynamical equilibrium of water in those particles has been reached. But it is necessary to get the correct water activity value out of the measurement.

There are a few approaches published as use of sorption isotherms to solve this problem. A new possible solution came up by using thermal treatment of the grain. This is rather usable for single ingredients with glass transition temperature ( $T_g$ ) in the range of 25-50°C. It is important to know that  $T_g$  depends on aw-value of the sample.

The idea is to heat the ingredient above its glass transition temperature for hours to break the capillaries and all internal structure; afterwards cool down. This way, the free water in the capillaries becomes detectable as nothing retains it. This will lead to higher but real water activity values once product is completely in thermo-dynamical equilibrium.

All this has to be done preferably in the water activity meter itself to avoid loss of free water. So, perfect chamber sealing is more than crucial.