The effect of lactose source on the stickiness of dairy powders

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Rosalind A Murti
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This thesis is dedicated to my late Grandfather Rev. Basil J. Hilder with much love.

"I see the solution to each problem as being detectable in the pattern and web of the whole. The connections between causes and effects are often much more subtle and complex than we with our rough and ready understanding of the physical world might naturally suppose" : *from "Dirk Gently's Holistic Detective Agency"*

ABSTRACT

The particle gun provides a valuable method to investigate powder stickiness properties. This method gives reproducible results when used under constant testing conditions and allows the isolation of factors influencing stickiness behaviour such as velocity and angle of impact. The $(T-Tg)_{critical}$ and rate of stickiness development obtained from the particle gun method were functions of the air velocity, angle of impact, powder a_w and ambient air conditions. Under constant testing conditions (feed rate of 0.3 $g.s^{-1}$, air velocity of 20 $m.s^{-1}$, ambient air at < 50 %RH, room temperature and constant powder a_w $(T-Tg)_{critical}$ was reproducible within ± 0.8°C while the rate of stickiness development was reproducible within ± 0.45 %deposition/°C.

The results obtained from the particle gun were consistently higher than the fluid bed results and can be explained by the different impact time and force experienced by the particles. Particle gun results can successfully be used to predict blockages in cyclones provided the appropriate correction is made for particle impact force and time. Blockage data from Te Rapa D5 indicates that the critical T–Tg where blockages occur in the cyclones is 27°C for SMP. Currently D5 is running satisfactorily for SMP at a T–Tg value of 28°C. Under these operation conditions the cyclone wall temperature results in a T–Tg value of 33°C, the same $(T-Tg)_{critical}$ value predicted by the particle gun for standardised SMP. This implies that the cyclone is operating correctly at the maximum T–Tg value before particles become sticky enough to cause blockage problems.

Protein standardisation of milk powder via the addition of milk permeate or lactose solution had no detectable effect on the stickiness characteristics of SMP or WMP as measured by the particle gun or the fluid bed rig. No difference was seen in either the bulk or surface composition of the milk powder. This provides evidence to dispel speculation by operators that permeate standardisation produces a more difficult to handle powder.

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