Measuring Moisture of Swedish Snus and Nicotine Pouches with The Cerulean Orion System

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Introduction

The oral pouch industry (snus) is predicted to grow substantially over the next 5 years (5.5% CAGR to reach $3.7bn by 2027[i]). This boom in pouch manufacturing should be accompanied by rigorous quality control measures.

Nicotine pouches were inspired by Swedish snus. Although they are consumed in the same way, they remain radically different in their composition. Nicotine pouches and snus have nothing in common. The Orion system can measure both snus and nicotine pouches.

Being able to accurately assess the moisture content of finished pouches - as well as dimensional accuracy, weight and pouch tensile strength - close to the production line gives manufacturing professionals the tools to optimise their processes. The Cerulean Orion test station delivers this ability.

Figure 1: The Cerulean Orion Snus Test station

The Orion system is an integrated test station specifically made for the testing of snus and nicotine pouches. The multi-axis robotic system moves pouches to various test points such as the high precision balance, moisture measurement station and the tensile test station. Physical dimensions are determined through use of high resolution imaging cameras.

The moisture content of modern oral products is a key quality parameter during manufacture. However, a fast lineside measurement of pouch moisture content is not without its challenges.

Unfortunately the high humectant content of pouches means that moisture is being lost of gained dynamically with the atmosphere. Table 1 shows four typical Swedish pouches, the moisture content (oven drying mass balance) and the rate of moisture loss in a typical manufacturing environment.

Speed is of the essence but simple mass balance using an oven as an option for determining moisture content or a Karl Fisher type extraction and titration are both slow, taking many minutes or hours to complete a measurement.

	Average pouch weight wet/g	% Loss per hour	Average dry pouch weight/g	Total moisture content %
Granit	0.81008	3.1%	0.45416	43.9%
Siberia	1.06557	1.6%	0.6734	36.8%
Copenhagen	1.46829	1.5%	0.63792	56.6%
Lundgrens	0.78206	1.0%	0.40294	48.5%

Table 1: Commercially available Swedish Snus brands used in tests. Pouches were removed from the tin immediately before use / measurement

An alternative to Karl Fisher or oven volatile determination would be to use microwave moisture measurement which is widespread in the tobacco industry and returns results in seconds. For snus or nicotine pouches this is not a viable method as the high levels of moisture in pouched products requires that the device is working in a region that is insensitive to change in moisture content. An alternative method is needed.

Cerulean developed a system for the Orion test station that measures the moisture content of snus based on resistivity and capacitance of the pouches which is then correlated to oven drying to produce a calibration curve.

Technical recommendations and sales support can be obtained from sales@cerulean.com or visit the Cerulean website at for further information and appropriate datasheets.

The measurements can be made in seconds, which compares with 15 minute or more for an oven system.

The accuracy of the system is in part a function of how the pouch is presented to the electrodes of the measurement device which is where the repeatability offered by the Orion robotic arm is able to deliver consistent results.

To understand the capability of the developed method moisture measurements were made using four different pouch samples which were then oven dried. The A to D count for the moisture device could then be plotted against “true” moisture content to give a linear calibration curve (figure 2).

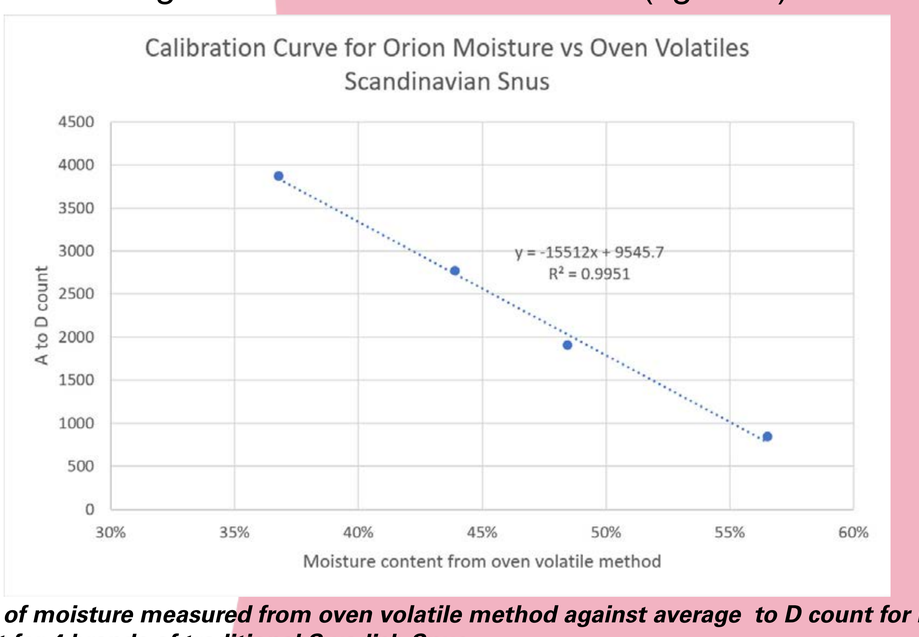

Figure 2: Plot of moisture measured from oven volatile method against average to D count for resistivity measurement for 4 brands of traditional Swedish Snus

Plotting mass balance moisture content against restively measured moisture content yields a graph to which a linear curve or a second order curve can be fitted. Pouches with significantly different compositions, such as white snus, will have different calibration curves. It is straightforward to create different calibration curves that can be stored in the Orion brand data system and recalled when brand changes are made. The wide range of moisture measurement available to this system is demonstrated above and moistures as low as 10% can be reliably measured.

As it is known that the pouches vary in both weight and probably moisture with time, so making repeat measurements on a single pouch would not be effective in determining the accuracy of this measurement technique.

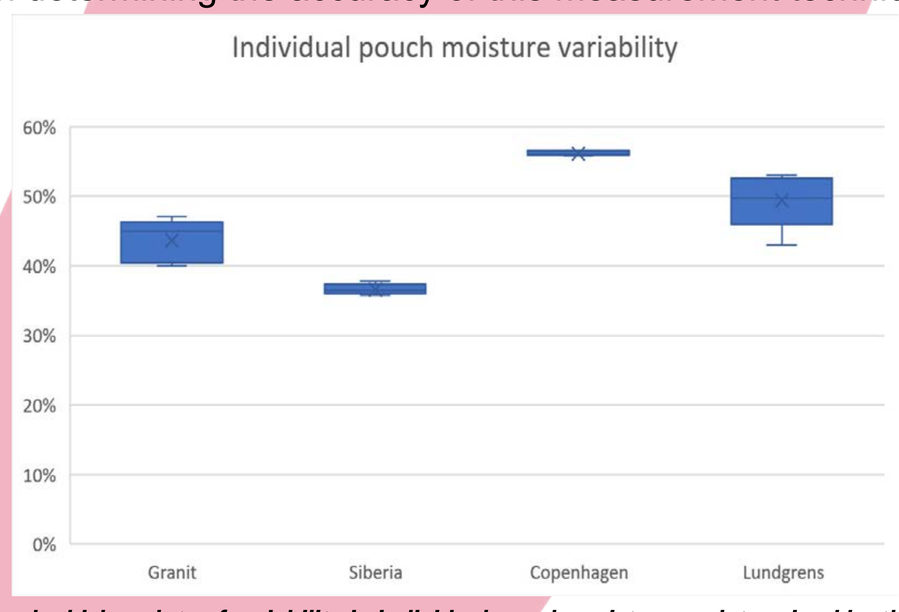

Figure 3: Box and whisker plots of variability in individual pouch moisture as determined by the Orion moisture measurement technique.

Instead a different method was tried to establish the intrinsic capability of the moisture measurement system – taking a batch of pouches and measuring each with the moisture meter, recording the A/D count, converting to a moisture using the calibration curves derived from oven heating, and then plotting as box and whisker plots.

Conclusion

The Orion uses a novel method for determining moisture in snus and nicotine pouches in a non-destructive manner. Using appropriate calibration curves the individual pouch moisture content can be determined in a matter of seconds.

Although “real life” pouch moisture content can be routinely highly variable (5% moisture content) the method shows an inherent moisture measurement capability of approximately ±1%.

Integration into a robotic test station such as Orion ensures that measurements are made before significant environmental moisture changes take place and measurements are made in a repeatable manner.

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