

GRAIN HYDRATION

STEAM INFUSION ADVANCED HEATING AND MIXING - FASTER PROCESSING WITH INCREASED BENEFITS

by Jake Norman, OAL

The hydration of grains is a critical process in the manufacture of Maheu, a grain-based drink widely consumed across Africa. Heating and mixing is a key aspect of the hydration process but an area where to date we have seen minimal change from the status quo. Steam jacketed vessels and agitation are the de facto method for heating products but manufacturers are turning to Steam Infusion advanced heating and mixing as a break from the traditional to process faster with quality benefits.

One manufacturer profiting from using OAL Steam Infusion to hydrate maize flour is Dairy Gold, an African Maheu beverage producer based in Zambia. Having sold their business to SABMiller in 2008, Dairy Gold had a good understanding of traditional processing technologies and were in search of new technologies to provide a competitive advantage for their new venture. Re-entering the market they believed there was a big opportunity to reduce operating costs dramatically and improve product quality.

What is Maheu?

Maheu is a traditional African non-alcoholic beverage made from maize meal, sorghum, sugar, milk solids and fermented with lactic acid. Traditionally homemade, the drink has become a major commercial success displacing sparkling beverages sales due to the nutritious nature of the product.

“At this point our company was seriously considering re-entering the market but needed to do this with a product and process which was superior to our competitors as well as being cost effective in this very demanding marketplace.”

Winani Chowa, Process Development Director, Dairy Gold Ltd.

The Steam Infusion difference

Following their search, Dairy Gold chose OAL Steam Infusion after testing proved the cutting edge Vaction™ technology used in Steam Infusion improved product quality and significantly reduced the system footprint and processing times of maize and other grains.

Traditional manufacturing systems are highly labour intensive and suffer from slow processing and production inconsistencies.

Operators often mix ingredients with paddles in vessels ranging in size from 100L to 1,000L with minimal levels of automation on the line.

OAL designed, built and commissioned their new start of the art hydration system in Zambia. Using patented Vaction™ technology, the Steam Infusion system can hydrate maize flour up to concentrations of 12%, at a rate of 15,000 litres an hour using only one 5,000 litre vessel. The maize slurry produced is then fermented at 60 degrees Celsius for 2 hours before continuously passing through 2 Steam Infusion Vaction™ units to heat the final product to 90 degrees before filling.

The Vaction Technology

Steam Infusion is a form of direct steam injection whereby culinary grade steam is directly introduced into a liquid product, with or without particulates. Steam Infusion utilises Vaction™ units on lances located within the vessel to introduce steam into the product. Steam is accelerated within the unit using a unique nozzle design that accelerates the steam to Mach 3 (three times the speed of sound). As this steam comes into contact with the product it creates a large dispersion zone and partial vacuum due to the Venturi effect. The steam then condenses and flows out as a uniform product. The partial vacuum means the unit acts like a pump, so product is pushed out of the unit and replaced with product to be heated. More than one unit can be implemented within a vessel to increase the possible heat transfer rate. Vaction™ units can also be mounted in the line of the pipework for powder entrainment, recirculation and continuous processing. For products with particulates, for instance meat cooks, the Vaction™ unit has a 45mm uninhibited bore so particulates can pass straight through the unit.

The Steam Infusion Vaction™ unit has been researched under a £1million government funded Innovate UK project to clearly define the operating envelope and product improvement opportunities offered by the technology.

“We are producing a superior Maheu product as well as a wide variety of other ambient drinks,



which are also being exported to many other African countries.”
Winani Chowa, Process Development Director, Dairy Gold Ltd.

Flexible Manufacturing

Due to consumers changing preferences products that are both smooth and gritty need to be manufactured on the same kit. By altering the steam flow rate through the Vaction™ unit, the level of shear can be increased and decreased allowing manufacturers to change the characteristics of the final product.

The installed system is simpler with fewer stages compared to traditional methods. Previously a maize slurry was premixed by hand before heating in a vessel with a steam jacket or a steam coil. The new Steam Infusion system instantly hydrates maize flour on a single recirculation system.

Dairy Gold have also benefited from energy savings. Unlike a traditional steam jacket, OAL Steam Infusion is a near perfect heating process with 95% of the steam energy transferred to the product. An area for which the technology has been recognised by both the Guardian Newspaper and Shell Springboard as a clean technology.

Zero Burn on Contamination

The partial vacuum and short residence time within the Vaction™ unit prevents the exposure of ingredients to excess temperatures in turn preventing product in contact with the kettle surface being burnt and affecting finished product flavour and visual quality. Traditionally easy to burn dairy based products taste fresher and are visually clearer.

What's culinary steam?

Culinary steam is filtered to be suitable for applications where the steam comes into direct contact with the food product being produced. Culinary steam is generally produced by filtering plant steam through a 5 micron filter to remove 95% of all particles larger than 2 microns than can potentially contaminate the final product.

Elevated temperatures

The Innovate UK research project into Steam Infusion is being conducted at the National Centre for Food

Manufacturing part of the University of Lincoln. At the centre there are various configurations of ways to use the Vaction unit; In-tank, In-line and single pass multi in-line. On the single pass multi in-line grain and cereal slurries can be heated from 10 to 135 degrees C in a single pass. The test centre is available for customers to try out the technology, at <http://try.oalgroup.com/steam-infusion/>

What's next?

OAL have seen high levels of interest in Steam Infusion for the hydration of grains and customers are able to visit the National Centre for Food Manufacturing in Holbeach, UK to test the technology. OAL have been working with the University of Lincoln to develop APRIL, a robotic chef that allows users to scale up how chefs prepare restaurant food using flexible robotic cells. APRIL links proven state of the art cooking, including Steam Infusion, and materials handling technologies with automated robotic ingredient loading.

A full-scale demonstration system is installed at the University's National Centre for Food Manufacturing.

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About the author

Jake Norman started working at OAL after graduating from the University of Bristol with a degree in Economics & Management. Having previously worked for Deloitte in both Audit and Consultancy streams, he recognised that he could make the biggest impact in an innovative SME.

Passionate about improving food, Jake has been heavily involved with OAL's two £1million UK government funded Innovate UK projects seeking to improve the cooking (OAL Steam Infusion) and cooling of food products (cryogenic cooling).

Jake has spoken about bring disruptive change and robotics in the food industry at various high profile food technology events including the "South African Association of Food Science and Technologists Congress" Pack Expo, USA and Gulfood, Dubai