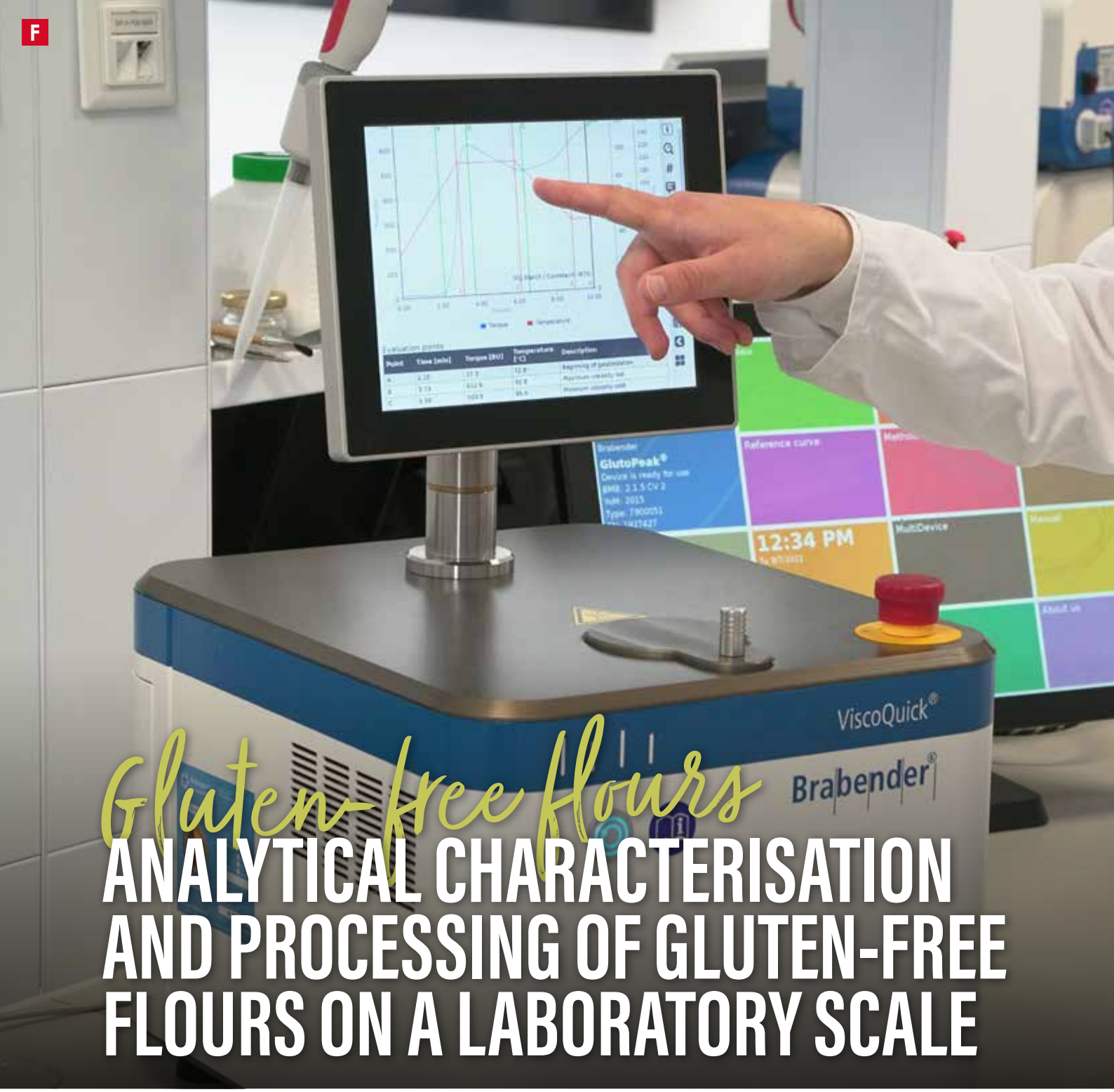


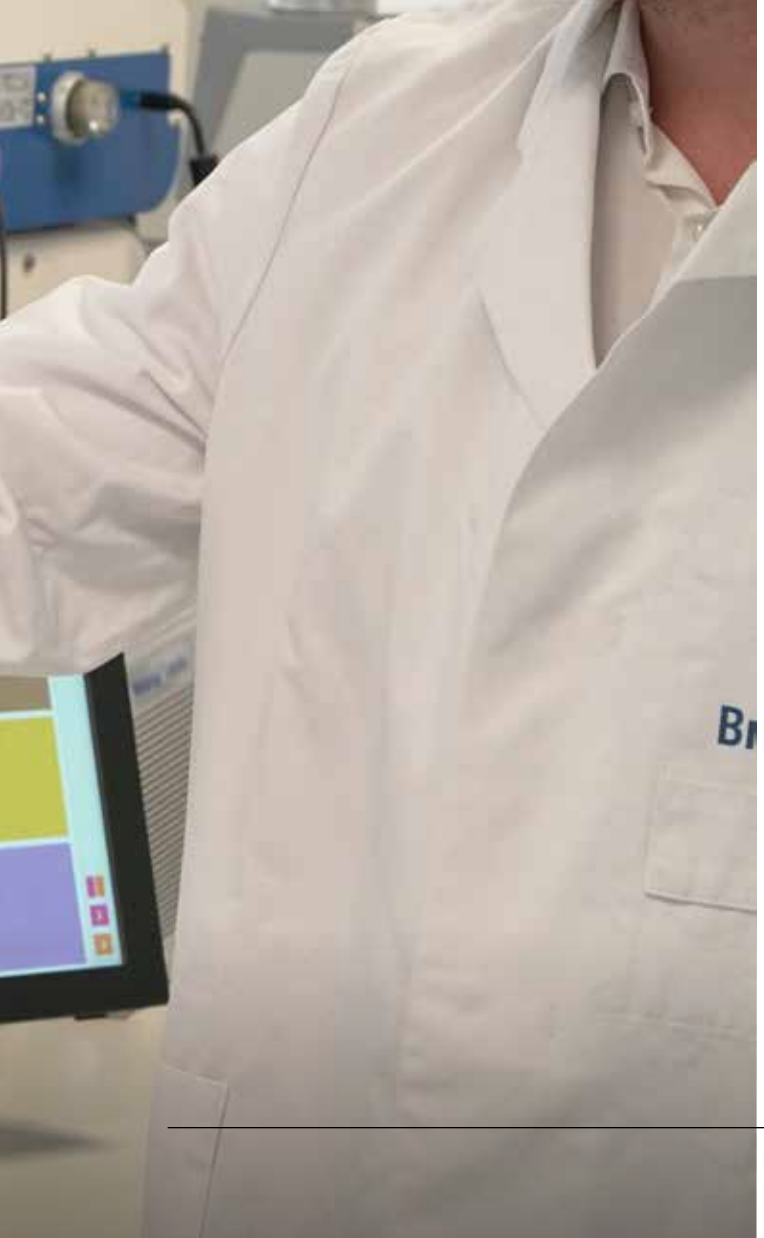
Gluten-free flours

ANALYTICAL CHARACTERISATION AND PROCESSING OF GLUTEN-FREE FLOURS ON A LABORATORY SCALE

by Markus Löns, Business Development Manager Food & Feed and Nicole Kuska, Content Manager, Brabender GmbH & Co. KG, Germany

A glance at the supermarket shelves makes it clear: products such as baked goods, snacks, meat, fish or sweets can also be found as alternative products. From lactose-free to sugar-free and vegan to gluten-free, the variety is great. For example, vegan meat analogues and gluten-free breads and pasta have found their way onto the shelves. There are several reasons for this. Besides the desire for animal welfare and environmental protection in the form of reducing CO_2 greenhouse gases, some consumers prefer alternatives for taste or health reasons. For example, consumers hope for better fitness or other nutritional improvements. Especially in the case of gluten-free diets, gluten intolerance, coeliac disease or wheat allergy can also be decisive factors for this type of diet. In the course of this dietary development, pulses have gained in importance, they are gluten-free and sustainable. They also have many nutritional benefits and increase the protein content in the diet. The market for protein from pulses is therefore predicted to grow steadily over the next six years.

When manufacturing products from pulses such as lentils, peas or beans, the analytical characterisation of the raw material is important to enable efficient product development in the long term: "There are currently few methods in the industry for determining the quality of pulses. Yet the quality of gluten-free raw materials, e.g. pulses, can be described on a laboratory scale



with our devices", explains Markus Löns, Business Development Manager Food & Feed at Brabender.

Flour analysis on a laboratory scale

Brabender has been developing, producing and distributing devices and equipment for testing a wide range of material properties since 1923. Already in 1928, the company developed the first Farinograph, a device for testing wheat flour and wheat dough. Other devices for testing flours for the milling and bakery industry eventually followed: "Modified flours, starches and other modern products of the grain, starch and bakery industry have always been the core and target market for Brabender. This also includes gluten-free flours and thus also flours made from pulses", says Löns.

The company, based in Duisburg, Germany, offers laboratory extruders that are suitable for product development of meat substitutes, snacks and pasta or other products made from legume flour, to name just one raw material as an example. Subsequently, the ViscoQuick viscometer, which has so far mainly been used in the milling, bakery and starch industries, can be used to determine the degree of starch gelatinisation and retrogradation. This method of starch gelatinisation is particularly useful in product development, but also in process control.

Influence of flour properties on the final product

Together with Müller's Mühle, Brabender has analysed the water absorption and gelatinization properties of legume flour with the Farinograph and the ViscoQuick. In addition, the two companies determined the oil absorption of e.g. lentil flour a time-saving method for determining the quality of legumes, such as lentils, peas, field beans and chickpeas.

In order to add the right amount of oil during the extrusion process when manufacturing meat substitutes from legume flour, the oil absorption properties of the flour must be determined. This is the only way to guarantee that the end product is good enough.

To determine the oil absorption of legume flour, the flour was filled into a measuring kneader and the torque was measured during the kneading process. At the same time, an automatic precision dosing pump continuously added the oil. Within three minutes, the oil absorption of the flour could be determined with little operator influence and only a few steps.

Manual method requires more time

The classic determination of the oil absorption of flour with the pipetting method needs significantly more working steps and takes more than one hour. In the future, the method is to be further optimised and also tested with further types of legumes. As part of the development of this measuring method, Brabender started a joint project with the University of Milan: "We extruded different types of legume flour to make meat analogues, including faba beans, but they taste rather mushy as the sole ingredient for meat substitutes. For example, faba bean mixed with yellow peas is recommended in terms of taste", reveals Jessica Wiertz, Manager Applications at Brabender. In addition to meat substitutes, other products can also be developed by extruding pulses. These include gluten-free pasta made from lentils and expanded lentil snacks.

Compared to other devices in the food and feed sector, the ViscoQuick can cool starch and starch-containing products to up to 100C after heating and gelatinizing the sample. In the past, lower temperatures were not possible from a technical point of view or could only be realised with great effort: "Devices with similar properties can only achieve cooling of up to 50oC. The advantage for the industry is now that with the new ViscoQuick products can be cooled down to the temperature at which they are consumed or further processed", Markus Löns emphasises.

This means that a measurement is possible that is closer to the real conditions and with which individual heating and cooling profiles can be used: "Different speed profiles are also possible, so that ultimately not only normal quality profiles can be run at one certain temperature or speed, but one can even simulate real processes", Jessica Wiertz explains.

Reduced measuring time with the ViscoQuick

The viscometer measures the torque in pasty masses: "With the help of this solution, we can determine and optimise the gelling behaviour of pulses as a basis for meat substitutes, desserts, sauces or confectionery," Wiertz summarises. In addition to the torque measurement, Brabender is also offering specific cups and paddles to determine also the viscosity in mPas or cP, if desired.

In contrast to other devices, which need about 120 minutes for a measurement, the measuring time with the ViscoQuick can now be reduced to 10 to 15 minutes and, if necessary, adjusted to even lower temperatures than 10oC. The reason for this is optimised temperature control. This is no longer done with the water bath, but via a Peltier element (can also be called a thermoelectric module or TEC). This is a kind of electrically operated heat pump that transfers energy in the form of heat from one side of the module to the other. In principle, Peltier elements are not new, but they have not been used in such measuring devices until now. This is where a Brabender innovation comes into play that considerably shortens the measuring time and makes exact measurement of the sample temperature possible.