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Dr. Harnisch Publications


**Cover: Quantifying Stability of Food Formulations**

**Heat Stable Plant-based Salami**

**Sustainable Manufacturing**

**Homogeneous and Hygienic Conveying**

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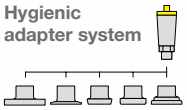

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Looking Forward VEGA

# The Dairy Dilemma

There is a lot of noise around veganism and its growth is continuing, even though the actual figures are still small. It seems to me that much of the conversation is about removing meat and animal products completely, but without considering the full story.

One argument, for example, is how much space animals take and how the land could be better used for crops to feed people, 10 billion of us by 2050. This sounds logical until we talk to farmers and realise that two thirds of global agricultural land is actually not suitable for crops which human can digest, but it is suitable for growing grasses and plants for ruminant animals.

Donna Berry, US food and beverage consultant and dairy expert, goes on to say: "These kinds of plants are basic sources of cellulose which humans cannot use for energy. However, ruminants digest cellulose and convert it into foods that humans can eat. Cows keep us from starving. They make the indigestible organic carbon available to humans in the form of high-quality protein, essential fatty acids and other necessary nutrients. Milk, for example, provides calcium, potassium, phosphorus, protein and vitamins A, B2, B3 and B12."

Milk from cows, goats and other animals and dairy products are staple foods for many of the global population. In Germany pressure groups are causing the dairy processors to evaluate their options. The dairy industry is the largest part of the German food sector, with approximately 27 billion Euros turnover making it the largest in Europe. There is a need to face up to the challenges from outside, but also inside as politicians, consumers and the market in particular, all seem to be choosing different interests.

Some of these challenges are universal for the current food industry – a need to modernise technology and to increase sustainable production. This includes reducing energy and waste and finding alternative uses for excess milk. There is a need to communicate with consumers to fully understand what dairy products can offer – see above – and to better inform how they can benefit. The dairy industry may also need to take a look at being competitive and offering a variety of more interesting products for some of the picky consumers.

Photo: GS

*Ian Healey*
*Editor-in-Chief*

Humans are omnivores, which means that we are physically capable of eating both meat and plants. Nutrients from animals significantly help us stay strong and healthy – as do many vegetables and plants. Fortunately, most of us can choose what we eat today. The significance of milk is great and it is good to preserve this in the future, as well as exploring new ways. To feed 10 billion people, we all need to play a part.

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# Contents


## Cover: DataPhysics GmbH

*Foodstuffs are often mixtures of different ingredients and are therefore liable to separate. It is important to quantify these separation processes to optimize food product formulations. A new dispersion stability analysis system, can reliably and efficiently analyze food dispersions regarding their destabilization and aging.*

Our Cover Story starts on page 6.

Key No. 102398

## Ingredients: Plant-based Salami

Many plant-based salamis, whether as a sliced product or whole, have a mouthfeel very reminiscent of mortadella and are soft and elastic in texture. “But that’s not how salami actually feels, right? Plus, they’re not made to be eaten hot, which is a shame when you’re craving vegan pepperoni pizza,” observes Loryma’s Head of Product Development, Norbert Klein. **Find out more on page 20**

## Processing: Sustainable Manufacturing

Soaring energy costs in the last year are significantly affecting many manufacturers’ bottom lines. Separately, the consumer pressure on FMCG brands to be more sustainable is only increasing. Combine both of these factors and it’s no wonder that manufacturers are urgently looking for new ways to reduce their consumption of natural resources like gas, electricity and water. **See the case study on page 22**

## Packaging: Hygienic Conveying

In the food industry, it is in the interests of people in charge of manufacturing or processing to rule out any hygiene risk. Any bacteria, foreign bodies or other contaminants that enter the product could cause incalculable losses. A new homogeneous conveyor and processing belt for exceptionally hygiene critical belt applications has been launched. **See the full story on page 38**

# Quantifying the Long-Term Stability of Food Formulations

**Foodstuffs are often mixtures of different ingredients and are therefore liable to separate. It is important to quantify these separation processes to optimize food product formulations. The MultiScan MS 20 dispersion stability analysis system, developed by DataPhysics Instruments, can reliably and efficiently analyze food dispersions regarding their destabilization and aging. The following use case evaluates five milk substitutes and compares the occurring destabilization mechanisms.**

*by Dr. Qiongjie Liu*

Many food products, such as milk products and mayonnaise, are complex multicomponent mixtures. In their production, a homogeneous composition with good flavor, texture, and nutritional value is desired. Separation processes in these mixtures can strongly influence their taste and mouthfeel. Assuring long-term homogeneity and thus a long shelf life for such products requires thorough optimization during the formulation of the mixtures.

The type and concentration of the formulation's ingredients, its processing temperature, pH, and viscosity are crucial parameters determining its separation behavior. Therefore, understanding the stability of food dispersions is important for research and development departments in the food industry. However, observing separation processes with the naked eye is highly subjective and time-consuming, hindering efficient formulation optimization.

## MultiScan MS 20: An Ideal Companion to Characterize Dispersions

To solve the above issues, the German measuring equipment manufacturer DataPhysics Instruments has developed the MultiScan MS 20 measuring device for automatic optical stability and ageing analysis of liquid dispersions (Figure 1). The device was particularly developed to characterize suspensions was well as emulsions and allow comprehensive time- and temperature-resolved analysis of destabilization mechanisms.

The MultiScan MS 20 comprises a base unit to which up to six sample chambers can be added. The base unit of the MultiScan MS 20 features an integrated touch screen, which displays status information and can be used to control important functions. Additionally, samples can be registered quickly and conveniently with a built-in scanner as well as an optional handheld barcode scanner. The six sample chambers of the MultiScan MS 20, called ScanTowers, can be individually controlled and operated at different temperatures. Electric heating, with liquid counter-cooling, enables measurements between -10 °C and 80 °C.

*Figure 1: DataPhysics Instruments' MultiScan MS 20 dispersion stability analysis system can be fitted with up to six sample chambers.*

## Visualising and Quantifying Destabilization Processes

With a MultiScan MS 20, destabilization mechanisms in dispersions can be visualized and quantified. The device achieves this by tracking changes in light intensity. It measures the sample repeatedly for a predefined period and in a position-resolved manner. The patterns arising in the light intensity can give a trained scientist information on how the dispersion changes over time and what destabilization mechanisms might cause these changes.

The experimental setup is as follows: A sample is placed in a glass vial, which is then placed in a measurement chamber. Two light sources and a light detector simultaneously move up and down along the sample (Figure 3). During the measurement, the whole sample height is scanned, detecting global and local changes in the sample. The software analyzes the light intensities transmitted through and backscattered by the sample. The transmission (light penetrating through the sample) and backscattering (light reflected by the sample) intensities depend directly on the number, size, and type of the dispersed particles. Hence, the light


*Figure 2: The five milk samples, pictured here at the end of the experiment*

intensity changes when the dispersion destabilizes.

Particles can sediment to the bottom of the sample container, so more particles scatter back light in the bottom layer. Particles can also cream, meaning lighter particles collect at the top of the liquid, meaning more light is scattered back in the top layer of the dispersion. In both cases, the measured profile of the dispersion shows decreasing transmission intensities, while the backscattering intensities increase in the respective area of the dispersion. Moreover, particles can cluster, minimising their interfacial area with the surrounding liquid phase. Such changes can be seen as global changes in the transmission and backscattering intensities.

### Use Case: Vegan Milk Substitutes

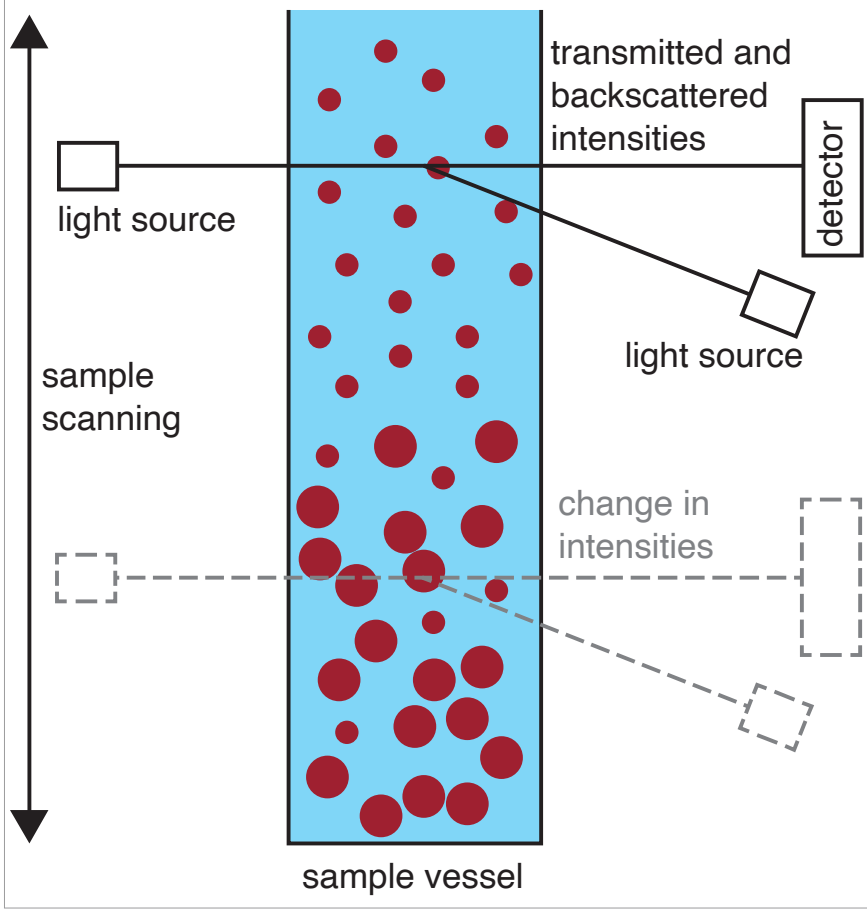
The following use case compares the destabilization mechanisms of five milk substitutes using the MultiScan MS 20. Milk substitutes are generally produced by mechanically breaking down plant materials, such as nuts, legumes, or seeds. The plant material is then mixed with oil, water, and colloidal matter to form a multiphase dispersion. This study characterizes five milk substitutes based on peas, oats, coconuts, almonds, and soy (Figure 2).

A sample of each substitute with a volume of 20 ml was homogenized using a shaker and then poured into a transparent glass vial to be measured at a constant temperature of 25 °C. The mixtures were measured every 6 minutes for a total experiment time of 1 day and 3 hours. The measured zone was between 0 mm (bottom of the glass) and 57 mm (top of the glass).

As the samples were opaque, the light cannot penetrate through the sample. Thus, the transmission intensities could not be used for evaluation. Therefore, the backscattering intensities were analyzed to study the stability of all five milk substitutes. The graphs in Figure 4 show the backscattering intensities against their height positions for all five samples. The color-coding of the curves indicates the time they were recorded, from red (start of the experiment, t = 0 s) to purple (end of the experiment, t = 1 day 3 hours). Each curve represents one measurement.

The backscattering diagrams show time- and position-dependent changes in the light intensities in all five samples. For example, the backscattering intensity of the oat-based substitute decreases at the bottom of the vial while increasing at the top over time. Thus, the particles migrate from the bottom layer to the top layer in a mechanism described as creaming. Regarding the coconut- and almond-based samples, the backscattering intensities at the top also increase; however, so do the backscattering values at the bottom of the sample vial. In this case, creaming at the top is accompanied by a sedimentation

*Figure 3: The measurement principle of the MultiScan MS 20: The two light sources and the detector move up and down the sample vial for each measurement.*



process at the bottom of the vial. Additionally, the middle layer clears as particles migrate to either the top or the bottom. The different assumed destabilization mechanisms are summarised in Table 1.

The software accompanying the MultiScan MS 20 enables a more detailed observation of specific areas to quantify the changes occurring. Figure 5 shows how the cream thickness in the top layer of the sample changes over time. The creaming processes in the oat-, coconut-, and almond-based drinks started instantly and were completed after approximately 2.5 hours. Conversely, the cream layers in the soy- and pea-based drinks formed much later. The cream layer in the oat-based drink was the thickest, with a height of around 3.6 mm, whereas that in the pea-based drink was the thinnest at around 1.5 mm.

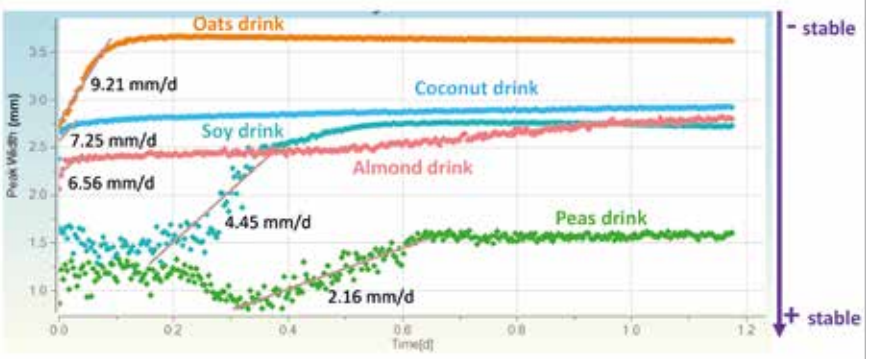
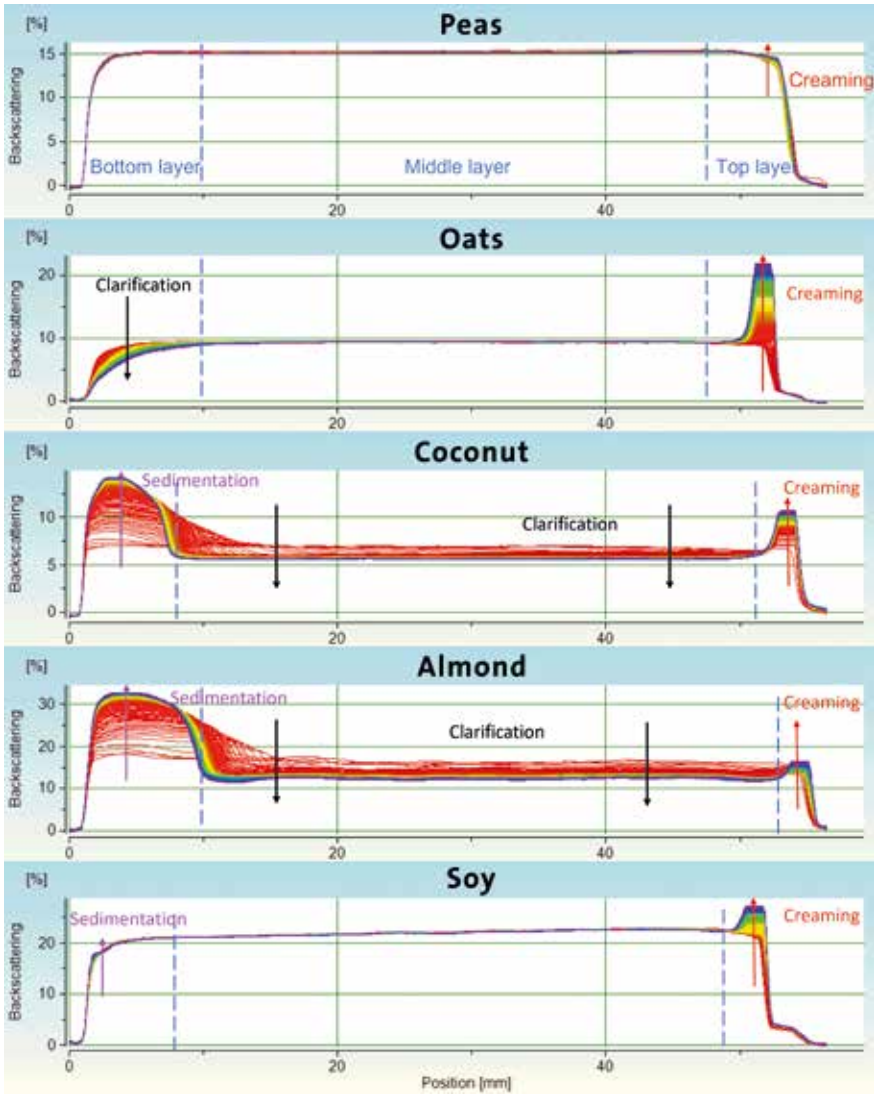



*Figure 5: The graph compares the thicknesses of the creaming layers at the top of the samples for all samples versus time.*

*Figure 4: The graphs show the backscattering intensity versus the height position for the five milk substitute samples. The color indicates the time of the individual measurement.*




Additionally, the software can reveal the sedimentation kinetics of the samples. The so-called 'peak-area change rate' of the almond-based drink was highest with a value of 418.8 mm%/d, whereas the change rate of the pea-based drink was lowest with a value of only 1.72 mm%/d. These results indicate that particles in the pea-based drink sediment much more slowly than those in the almond-based drink.

The software can also provide a global stability analysis using the stability-index (SI) function. This function summarises and quantifies the effects of various destabilization mechanisms over the entire sample height. With these SI values, the stability of different products can be compared directly (Figure 6). Consistent with the changes in backscattering intensities, the pea-based drink was found to be the most stable formulation, while the stability of the almond drink was the lowest. These results underline the excellent applicability of the MultiScan MS 20 to analyze and quantify stability issues of different formulations with high reliability.

## Conclusion

Destabilization processes occur in most multicomponent mixtures, including food products. Such processes strongly influence the product's final appearance, taste, and feel. Therefore, it is essential for research and development departments in the food industry to quantify and analyze the destabilization processes of multicomponent mixtures. Such

| Sample | Bottom Layer | Middle Layer | Top Layer |
|---|---|---|---|
| **Pea** | - | - | Creaming |
| **Oat** | Clarification | - | Creaming |
| **Coconut** | Sedimentation | Clarification | Creaming |
| **Almond** | Sedimentation | Clarification | Creaming |
| **Soy** | Sedimentation | - | Creaming |

*Table 1: Possible destabilization mechanisms for the five milk substitutes, broken down into top, middle and bottom layer*

evaluations enable efficient optimization of the product formulations. Using the MS 20 dispersion stability analysis system and its corresponding software, a quantitative and exact means to study the stability of multicomponent mixtures, such as plant-based milk substitutes, was shown. With this device, changes in light intensity can be detected readily and reliably, enabling producers to anticipate and quantify stability issues and thus allow time- and cost-optimized product development. fmt

The Author:
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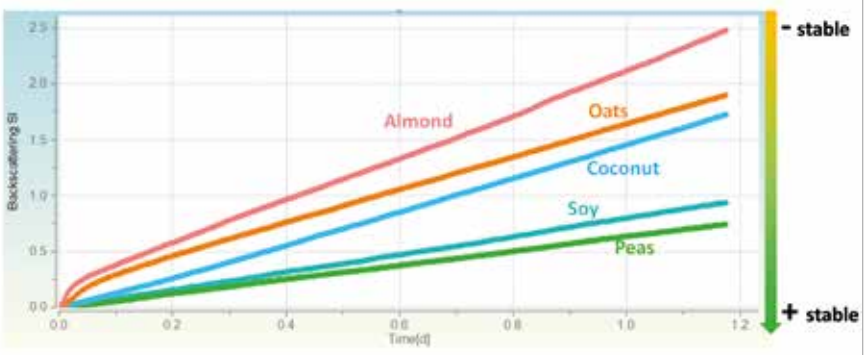


*Figure 6: The stability indices of all samples, calculated from the backscattering intensities versus time*

# High-Purity Coconut Oil

**Ensuring quality from the plantation to the end product**

**Currently, coconut oil is experiencing a revival and there's no question that it's more popular than ever. However, a report by the magazine Ökotest, a German consumer magazine published since 1985, shows that even certified organic coconut oils can contain mineral oil residues. The reason for this is that the chemical structure of the raw material can sometimes accumulate MOSH/MOAH. To ensure the production of high-purity products, oil refinery expert Nutriswiss relies on controlled supply chain management.**

*Michel Burla, CEO of Nutriswiss*

All-rounder coconut oil can be used both in the kitchen and the bathroom — for baking, cooking and body care. Although coconut oil is now widely used, sourcing remains a challenge for the industry. Why? "Cultivation and transport are always associated with risks for oils and fats," explains Michel Burla, CEO of Nutriswiss. "However, a controlled supply chain is even more important for coconut oil than other similar ingredients. Handling the product during transportation typically represents a major risk factor; the social conditions of the producers in the countries of origin are also a key issue. Therefore, we have installed mechanisms that guarantee the high quality of the raw material."

## Quality control: decreasing the risk of contamination

Crude oils such as coconut quickly absorb contaminants from the environment. Aggravating factors can be a lack of expertise and limited economic and technical possibilities for coconut farmers: if the cobra (the fruit flesh) is dried in the traditional way over an open fire, contaminants from the smoke can get into the final foodstuff. Burla notes: "In the EU and Switzerland, a maximum limit for the sum of four heavy polycyclic hydrocarbons (PAHs) of 10 ppb applies to coconut oil; owing to the hazard potential of benzo(a)pyrene, only a maximum of 2 ppb is permitted." In addition, mineral oil residues can also originate from exhaust gases, technical oils or the additives needed to operate the machinery during pre-processing on the plantations and in the production facilities.

In terms of transportation, the longer the route, the more numerous the intermediaries and stations and, therefore, a greater risk of contamination. Open loading operations and contact with pipes, ambient air and other goods in transit can cause contaminants to accumulate in the raw material. Contact with oxygen causes the oil to oxidize and become rancid. In conventional logistics chains, every kilo of crude oil is reloaded or pumped up to six times during transport. To make matters worse, only the last three shipments are documented in maritime transport. In this way, it remains unclear whether a previous cargo contained diesel oil, for example. The composition of the cargo and the hygienic purity of the containers cannot then be guaranteed. As a specialist in the processing of oils and fats, Swiss company Nutriswiss relies on procedures that ensure the delivery of the highest quality products, even if the oils are very sensitive.

## Maintaining a secure supply chain

The key to high-quality crude oils is raw material sourcing. In this regard, the Swiss refinery follows an individual and very elaborate path that prioritizes quality, sustainability and social standards. The coconut oil is sourced from long-standing contractual partners, mainly from countries in the west and southeast of the African continent. In-house standards and controls are a prerequisite. "Only close cooperation and knowledge of local conditions provide a suitable basis for safeguarding and improving the quality of coconut oil," explains Burla.

The collaboration makes it possible to influence the raw material´s properties, quality and, sometimes, even the harvest dates. The raw material is loaded into refinery-owned food-grade ISO containers, the purity of which is controlled by Nutriswiss. The loaded

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containers are sealed, tracked during transport and only opened again at the Swiss plant. This prevents contact with oxygen and foreign matter. This procedure almost completely rules out any risk of contamination from the country of origin to the processing plant. The raw materials are sampled as soon as they are filled into the containers and then examined in the Swiss quality laboratory.

## Responsibility and sustainability

Nutriswiss works closely with non-profit organizations and funds activities aimed at economic improvements for regional partners. This includes visiting the contract partners on site and confirming compliance with standards. "Many small farmers and their families earn a large part of their livelihood from the sale of coconut oil. We therefore see it as our responsibility to continuously improve the situation on site," says Burla. The cooperation with the plantation operators is designed for the long-term. Only in this way can improvements be developed, tested and established during several harvest cycles. Nutriswiss is happy to share its knowledge about possible contamination: "In the long run, the growers benefit from long-lasting coconut palms and high-quality yields, which is our common goal," says Burla. Representatives from the refinery check and document processes on site and ensure that the coconut oil meets the highest standards of quality.

Manufacturers and processors of vegetable oils are faced with increasingly strict limits. These regulations are an expression of a political and social system that's striving for the highest levels of food safety. "Sensitive oils, such as coconut oil, comprise part of the daily business of many food manufacturers and also for us. Whether for infant food or other applications, we always put a great emphasis on the highest quality and a balanced recipe," notes Burla.

## Purification for highest quality

Once at the plant, the company's own quality laboratory not only provides a detailed review of the extent of possible contamination, but is also responsible for check-ing the finishing process: a comprehensive fat index profile is created for each product before, during and after processing. Burla comments: "The degree of pre-contamination of the raw material varies greatly, which is why our processes are as flexible as possible. This allows us to get the best out of every raw material in terms of the analytical and sensory properties that match the final product we are aiming for." Nevertheless, it's clear that the material that leaves the Nutriswiss plant is significantly less contaminated than the goods provided: "The detected values of MOSH/MOAH are much lower, as are the pesticide residues; these are remarkable effects," Burla confirms.

The raw material is then alkaline neutralized, bleached, filtered and finally deodorized. Unlike traditional vegetable oil refining, Nutriswiss does not require the time- and temperature-intensive processes for the removal of pesticides and mineral oil residues (MOSH/MOAH). Instead, the company relies on physical treatment

using modern distillation technology followed by mild deodorization. In this way, the formation of process contaminants is minimized, while pesticides, MOSH/MOAH, polycyclic hydrocarbons (PAH) and plasticizers such as DEHP are significantly reduced. At the same time, valuable ingredients are protected and yield losses are minimized.

Nutriswiss supports customers from initial idea to market maturity and offers pilot-scale modification trials. A large part of the Nutriswiss portfolio comprises special products that are developed and tested to meet customers' specific requirements. How exactly the profile of an oil is modified or whether a special blend is developed depends strongly on the respective application. At the end, customers receive a protocol that precisely documents the quality differences between the input values and those of the final product. Nutriswiss successfully masters the balancing act between moderate process parameters and effective purification based on many years of expertise with sensitive special oils. Diligence, monitoring in the company's own laboratory and the innovative combination of technical processes ensure that the refined product always shows measured values that are close to the detection limit(s).

## One product, many applications

Depending on the room temperature, coconut oil can be solid (below 25 °C) or creamy or liquid (above 25 °C). Owing to its high content of saturated fatty acids, it's very heat-stable and ideal for baking, cooking and deep frying. However, it's also often used as an alternative to palm oil as it has similar technological properties. In the development of palm-free filling fats, couvertures and glaze masses for the chocolate and confectionery industry, coconut oil serves as a structuring base and also produces a cooling effect in the mouth. It gives vegan alternative products such as vegetable cream cheese the necessary firmness and ensures a pleasant melting sensation. Coconut oil is also used in cosmetics such as body or haircare products.

## Swiss expertise, global reach

Nutriswiss AG specializes in the refining of high-quality, tailor-made edible fats and is the Swiss leader in special and organic products. For national and international food manufacturers, the catering, cosmetic and pharmaceutical industries, as well as artisan bakers, crude oils from all over the world are neutralized, bleached, modified by fractionation, transesterification or hydrogenation, mixed and deodorized.

Burla concludes: "It's important to remove impurities and residues from oils, to optimize their properties and to source the raw materials sustainably. At the same time, both consumer demand and legal requirements must be met. We take our responsibilities very seriously; what leaves our plant is a perfectly safe food." At its headquarters in Lyss in the canton of Berne in Switzerland, a total of 90 employees produce around 55,000 tonnes of high-purity edible oils and fats annually, 95% of which are of vegetable origin. Manufacturers can purchase the oils that have been imported and processed by Nutriswiss directly. In addition, it's possible to have self-provided oil processed on a contract refining and manufacturing basis. The Swiss company refines batches in the range of 500–2500 kg. This makes it possible to refine even very small quantities of rare oils, for example, to develop suitable fat components for novel foods. fmt

# Replacing Methyl Cellulose in Plant Based Burgers - Is it Worth it?

*by Dennis Seisun and Nesha Zalesny*

Methyl cellulose is unique amongst hydrocolloids. It is the only one that, in solution, will gel when heated and liquefy when cooled. Methyl cellulose, E461, we are told, does not look good to consumers on a food ingredient label. As a result there are on-going efforts to find a replacement for methyl cellulose. What are the pros and cons of trying to substitute methyl cellulose with another hydrocolloid or gelling system? Read on.

The unique thermo-gelation property of methyl cellulose has made it a 'de rigueur' ingredient in a number of applications especially in fried foods and more recently in plant based burgers. In fried foods, MC gels upon heating and prevents or reduces oil intake thus reducing calories. In plant based burgers MC provides strong binding during the high cooking temperatures while grilling the patty. As the burger is cooled to eating temperatures the MC gel will soften and provide 'succulence' during chewing. It is this latter application, plant based burgers, which has driven MC consumption up dramatically in recent years. The skyrocketing consumption of two well known brands of plant based burgers, Impossible Foods and Beyond Meat along with a few others even resulted in a longer delivery lead time (read tight supply ?) situation for methyl cellulose. The initial double digit and maybe triple digit growth rates caught ingredient suppliers off guard. Lead times have now eased just as the growth of this market has slowed or maybe plateaued. Plant based burgers became such an important market that a special grade of MC for this application has been developed. The two leading MC suppliers, IFF (legacy Dow) and Ashland (legacy Hercules) have an "MX" grade of MC with gelling and melting profiles specifically designed for plant based burgers. The MX grade properties are tailored to be best suited during grilling (high temperature) and also at 'eating temperature' when maximum 'succulence' is experienced. The MX thermal gelation and liquefaction curve is optimized for the cooking and eating temperatures. There are several other producers of MC which offer tailor made grades for this application. Lotte of Korea, Rettenmaier of Germany, Shin Etsu of Japan (Germany), and Shandong Head of China.

A use level of about 1-2% of MC by weight is applied in plant based burgers. The lower use level around 1% is for the special 'super gelling MX' custom grade of MC produced specifically for plant based burgers. Standard grades of MC will also work but need a higher use level and have slightly different gelling properties and set points.

The efforts to replace MC in plant based burgers is purportedly to "clean the label" and address alleged growing consumer concerns about its presence on the ingredient list. Attempts to replace methyl cellulose started some time virtually as soon as the plant based movement started. In fact methyl cellulose itself was used to replace a blend of xanthan and konjac gum which were the gelling/binding agents in the initial Impossible Foods formulation.

So far no ideal replacement for MC has been found. This is not surprising really, considering that no single hydrocolloid or blend of hydrocolloids offers the same unique thermal gelation property of methyl cellulose. Citrus fiber (with pectin) is being touted by some citrus fiber producers as a good MC replacement. The pectin within the citrus fiber is a gelling agent but it is NOT a thermoreversible gelling agent. The xanthan/konjac blend which Impossible Foods started with forms a gel but it is NOT thermoreversible. Of all the suppliers and combinations touted as a replacement for MC, none offer the one property which makes MC unique, a thermoreversible gel. This glaring shortcoming, however,

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has not prevented many claims of MC replacement by several companies.

**The ingredient list for Impossible Foods' plant based burger is nearly 20 items long of which MC is seventh as indicated in the below list:**
*Water, Soy Protein Concentrate, Coconut Oil, Sunflower Oil, Natural Flavors, 2% Or Less Of: Potato Protein, Methylcellulose, Yeast Extract, Cultured Dextrose, Food Starch Modified, Soy Leghemoglobin, Salt, Mixed Tocopherols (Antioxidant), Soy Protein Isolate, Vitamins and Minerals (Zinc Gluconate, Thiamine Hydrochloride (Vitamin B1), Niacin, Pyridoxine Hydrochloride (Vitamin B6), Riboflavin (Vitamin B2), Vitamin B12).*

**Here is the same list with MC removed. How much simpler and cleaner does it look?**
*Water, Soy Protein Concentrate, Coconut Oil, Sunflower Oil, Natural Flavors, 2% Or Less Of: Potato Protein, Yeast Extract, Cultured Dextrose, Food Starch Modified, Soy Leghemoglobin, Salt, Mixed Tocopherols (Antioxidant), Soy Protein Isolate, Vitamins and Minerals (Zinc Gluconate, Thiamine Hydrochloride (Vitamin B1), Niacin, Pyridoxine Hydrochloride (Vitamin B6), Riboflavin (Vitamin B2), Vitamin B12).*

Besides MC, two other ingredients in the Impossible Burger are probably on the 'to be replaced' list by formulators, soy leghemoglobin, a GMO ingredient and modified starches because modified anything is a consumer concern.

**The ingredient list for Beyond Meat burgers is a little longer but perhaps "Cleaner" because no GMO need be declared:**
*Water, pea protein*, expeller-pressed canola oil, refined coconut oil, rice protein, natural flavors, dried yeast, cocoa butter, methylcellulose, and less than 1% of potato starch, salt, potassium chloride, beet juice color, apple extract, pomegranate concentrate, sunflower lecithin, vinegar, lemon juice concentrate, vitamins and minerals (zinc sulfate, niacinamide [vitamin B3], pyridoxine hydrochloride [vitamin B6], cyanocobalamin [vitamin B12], calcium pantothenate).*

The key differences between Impossible Foods and Beyond Meat burgers are as follows:

1. As the main protein source, Impossible Foods uses soy (GMO) and Beyond Meat uses pea (non-GMO)
2. Impossible Foods uses Soy leghemoglobin, a GMO product to mimic the red color/bleeding of regular meat. Beyond meat uses a natural color from beets.
3. Beyond Meat eschews the use of 'modified starch' which Impossible Food uses.

Both Impossible Foods and Beyond Meat, however, rely on the unique properties of MC in their formulations. The long list of about 20 ingredients would be hard to designate as 'clean' by any interpretation of what is a 'clean label'. Why then, are these plant based burgers so popular and, until recently, growing at double digit rates? The simple answer is 'feel good' accompanied by 'taste good'. Consuming plant based burgers may not be 'clean label' but it leads to 'clean for those consuming them. The main arguments driving plant based burger consumers are: animal welfare, climate change and nutrition efficiency. In exchange these same consumers are willing to sacrifice, clean label and cost as long as taste is good. The cost of plant based burgers remains significantly higher than animal based burgers. Higher costs for plant based are found at food service/fast food and at retail outlets. It is likely that plant based marketers are factoring a 'feel good factor' in their pricing rather than basing higher prices on raw material costs alone.

So, bottom line, is it worth replacing MC in plant based burgers? In our opinion, the answer is NO. Removing MC would not make the label much cleaner, if at all. The MC would likely be replaced by one or more ingredients. The number of ingredients on the list would be the same or maybe even longer. Xanthan and konjac which gel synergistically, were in the original Impossible Foods formulation. Going back to that combination is unlikely in view, sadly, of the negative image which some consumers attribute to xanthan. Suppliers of citrus fiber with pectin content claim to have a replacement for MC. The declaration of citrus fiber is definitely cleaner sounding on a label than MC. Our technical insight,

however, still places a significant functional advantage with MC which would have to be sacrificed in going to a citrus fiber. Replacing MC is more complex than meets the eye. There are several grades of MC offered in plant based formulations by several producers. There are differences in functionality and performance even within the supply of MC itself. Some grades for example will produce the right "knack" in a plant based sausage whereas that of another supplier will not even if product specifications are the same.

From a consumer point of view, replacing MC would not change the primary reason(s) for which they are consuming plant based burgers. Consumer concerns include the environment (global warming), animal welfare, social conscience. These are the main drivers to plant based burgers but there is also the novelty aspect of trying 'something different'. Price is not a 'deal breaker' for plant based burgers which are generally more costly than animal products. One consumer when asked "How much more did you pay for the plant based burger" said, "Oh I forgot to check". i.e. price was no object. That is not to say that price is not a consideration for the general public. Burgers, especially in the fast food service outlets, are the staple of cost conscious consumers.

Looking to the future of plant based burgers, with or without MC, there is likely to be a plateau or 'plant based fatigue' in the next year or two. Double digit growth may slow to single digits. The broader plant based consumer needs time to digest, pun intended, the social and economic meaning of a radical change in diet. Yes it is a radical change even if plant based burger producers do their utmost to make it hard to discern between plant based and animal based burgers. We expect a renewed growth curve for the plant based movement in the coming years. At the same time, however, we issue a caveat: Consumers are fickle they may change their mind on a whim and often not for scientifically proven reasons. Reformulation of an accepted food is risky. Remember the "New Coke" by Coca Cola or "McClean" by McDonalds, both fiascos? Food reformulation is challenging beyond simply juggling ingredients. Methyl cellulose is a good product with a unique function. Spending too much time trying to replace it is likely to be wasteful and fruitless. fmt

The Authors:
Dennis Seisun is Founder of IMR International. Nesha Zalesny, Food Scientist, is Partner at IMR and together they are publishers of The Quarterly Review of Hydrocolloids, the information center for food texture, and organizers of a global hydrocolloid conference since 1998. The next conference is in Malta April 23-25, 2023 with the headline "Battling Hydrocolloid Challenges".

# Prebiotic Effect Evidenced for Chicory Root Fibers by the First Systematic Review with Meta-Analyses

**Intake of chicory root fibers increases Bifidobacteria and supports bowel function**

A new systematic literature review with meta-analyses, conducted by Dávid U. Nagy et al.[i], demonstrates that chicory root fiber intake (starting at 3g/day) promotes significant growth of Bifidobacteria in the gut microbiome in all age groups and improves bowel function parameters. It is the first study of this kind, based on randomized control trials, that has investigated the effect of inulin-type fructans derived from chicory root on Bifidobacteria abundance in gut microbiota and health-related outcomes.

Included in the systematic review with meta-analyses, considered the strongest methodology in the hierarchy of scientific evidence, were 50 human intervention studies, with a total of 2,495 participants. These were selected based on an extensive literature search and review process that followed the guidelines of the Cochrane Handbook for Systematic Reviews and Interventions[ii]. This research evidenced that inulin, oligofructose and combinations thereof, derived from the chicory root as the source of origin, act as a bifidogenic factor, promoting the selective growth of Bifidobacteria. The systematic review with meta-analyses also demonstrates that chicory root fiber is a prebiotic that complies with the ISAPP (International Scientific Association for Probiotics and Prebiotics) definition of pr ebiotics.

The researchers further reported that the bifidogenic effects of the chicory root fibers were accompanied by improved bowel regularity. This was validated by increased stool frequency in healthy adults, and by softer stools in healthy infants and children.

Commenting on the findings, Anke Sentko, Vice President Regulatory Affairs & Nutrition Communication at BENEO said: “I am extremely pleased that this detailed critical systematic review with meta-analyses has been conducted. Following the highest quality scientific evidence

methodology, the prebiotic effect of inulin-type fructans sourced from the chicory root is confirmed. It yet again shows that integrating chicory root fibers into a person's daily diet supports Bifidobacteria and thus their gut microbiome, while also improving the bowel functions of the very young to the very old."

BENEO's prebiotic fibers, Orafti® Inulin and Oligofructose, are inulin-type fructans. They are natural, non-GMO, clean label prebiotic fibers that are derived from chicory root via a gentle hot water extraction method, unlike some other fibers that are artificially or chemically made. They can be used in a wide range of food and beverage applications including baby food, according to national legislations. As proven prebiotics, chicory root fibers (inulin, oligofructose) support a healthy gut microbiota and selectively promote the growth of beneficial microorganisms, such as Bifidobacteria, in the gut. Chicory root fibers are the preferred food for those good microorganisms and thus help them to grow and multiply. Due to the increased bacterial metabolism in the large intestine, regularity is improved. fmt

i) Nagy DU, Sándor-Bajusz KA, Bódy B, Decsi T, Van Harsselaar J, Theis S & Lohner S (2022) Effect of chicoryderived inulin-type fructans on abundance of Bifidobacterium and on bowel function: a systematic review with metaanalyses. Critical Reviews in Food Science and Nutrition. Published 14 July 2022, DOI: 10.1080/10408398.2022.2098246
ii) Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). Cochrane Handbook for Systematic Reviews of Interventions version

Photos: BENEO

# Challenge Accepted: Heat Stable Plant-Based Salami

**The news that plant-based diets are growing in popularity is no great surprise. The appetite for alternatives free from animal products began years ago with substitutes for nuggets and patties. However, mimicking the firm and rough texture of an Italian salami, for example, presents manufacturers with a major technological challenge. Fed up with plant-based salami that tastes and feels like dark-colored mortadella, German wheat ingredient specialist Loryma has now developed concepts using special binding agents, texturates and starter cultures to make salami that tastes great not only on bread but also pizza and other hot food.**

Perhaps it's the German tradition of mostly eating cold dinners: topping slices of bread with a selection of delicacies from the cheese and deli meat counters was the motivation for the Loryma R&D team's latest innovation, which was also inspired by Italian specialties. The global market for meat alternatives being valued at USD 5.4 billion (2021) and forecast to grow by a CAGR of 11 per cent until 2029 (1) was a motivating factor, too.

The team developed a range of different wheat-based binders to suit the peculiarities of various types of sausage, particularly salami. Many plant-based salamis, whether as a sliced product or whole, have a mouthfeel very reminiscent of mortadella and are soft and elastic in texture. "But that's not how salami actually feels, right? Plus, they're not made to be eaten hot, which is a shame when you're craving vegan pepperoni pizza," observes Loryma's Head of Product Development, Norbert Klein.

*Norbert Klein, Head of Product Development at Loryma.*

## Superior plant-based salami

Wheat is not necessarily the first raw material that comes to mind when one thinks of meat alternatives. Yet it's an outstanding ingredient as a result of its technological advantages and sustainability credentials. Wheat scores highly thanks to its multifunctionality, meaning almost 99 per cent of each grain can be used through the production of co-products, ensuring a resource-saving approach to the environment. Loryma processes only European wheat, which minimizes both transport emissions and the risk of supply bottlenecks. From a technological perspective, functional ingredients from wheat can be used in the production of food, especially meat alternatives, to optimize texture and nutritional value, while being sensorially neutral.

Combining wheat ingredients like texturates and binders is a powerful fusion. Norbert Klein and his team are constantly developing new concepts in this context – and, in some cases, also new functional blends if necessary. "A completely new approach on the ingredient side was needed for our plant-based beef jerky," he says. "The wheat-based binder we developed for this project is also perfect for use in a heat stable salami." It ensures heat stability and an authentic, slightly brittle texture. Starch-based binders are not suitable here as they are not particularly temperature stable. For the wheat salami, the binder partners with Lory® Tex Fibres – elongated textured wheat proteins with a fibrous, meat-like texture. The amount of water added to the dry texturates for swelling determines the anticipated firmness.

*Loryma_Plant based Salami©Crespel & Deiters*

*Loryma_Plant based Salami Pieces©Crespel & Deiters*

### Create distinctive properties.

The solution to the challenge of mimicking the rough, fibrous, almost crumbly salami texture lies mainly in the production process. "There are two options. One is quick while the other needs more time and effort, but pays off in terms of taste and properties," Klein explains. The simple way is to add edible acids like coated citric acid, for example, and cook the salami. The more elaborate alternative is to ferment with microorganisms and let the sausage mature before cooking, just like a meat salami. "It does not work with every culture and pH value, but some conventional starter cultures from the meat industry work well. In my opinion, if you want an authentic salami texture, fermenting is the way to go," adds Klein.

To further reinforce the overall impression of a visually and sensorially authentic product, a slightly creamy fat substitute can be added, regardless of the subsequent consumption temperature. It is based on Lory® Stab, a combination of wheat gluten, wheat starches and gelling agents. The "fat" pieces are comparable to those of real salami, both visually and in terms of consistency. They do not melt in heat, which means the salami alternative can be seared without loss of quality.

The nutritional values of plant-based sausages are sometimes heavily criticized because many products cannot compete with their meaty counterparts. However, wheat-based salami, produced according to Loryma's application recommendation, can contain at least as much protein as a conventional one made from beef, thanks to soluble wheat protein broken down by enzymatic hydrolysis.

### No limits in taste and possibilities

With nutritional values in mind, the product development team has also optimized its plant-based cold cut concept which is, with slight modification, the basis for a vegetable mortadella alternative and related varieties such as baloney. With the aim of achieving a texture that is elastic with light resistance, just like the original, two different binders from the Lory® Bind range are used. These contain wheat starches and hydrocolloids. Many vegan products on the market contain just 2.5-4 per cent protein, while meat products usually contain about 12 per cent animal protein. Klein explains: "By adding hydrolyzed wheat protein, our mortadella alternative can not only match the protein content of traditional mortadella, but also has about 5 percentage points less fat."

### Exploiting the potential of wheat

Loryma have a number of binders in their portfolio, but the team can create additional adaptations for specific customer projects. Efforts are being made to explore synergies too – for example, the plant-based concept for a vegan chicken breast is based on the same binder as that used in beef jerky and the salami. Of course, just like vegan mortadella, for which a clean label binder can also be used, products can be further processed, for example, for use in delicatessen salads.

As all wheat ingredients are flavor-neutral and odorless, they are the perfect carriers for individual flavoring. "We work in cooperation with an aroma producer and suggest flavorings for various concepts. But, of course, every producer can realize his own ideas and is invited to vary the recipe and preparation in any way," says Klein. "That's what I find so exciting about wheat. Although it's a familiar and trusted ingredient, it has so much potential. As a sustainable, plant-based raw material, it is perfect for optimizing contemporary food concepts." fmt

(1) Market research report from Fortune Business Insights (2022), available online via https://www.fortunebusinessinsights.com/industry-reports/meat-substitutes-market-100239 (latest access: 12 September 2022).

# Reducing Natural Resource Consumption in Manufacturing

*by Simon Copley*

Soaring energy costs in the last year are significantly affecting many manufacturers' bottom lines. Separately, the consumer pressure on FMCG brands to be more sustainable is only increasing. Where once consumers used to equate the concept of sustainability just with packaging and recycling, now their awareness also includes the natural resources used during manufacture.

Combine both of these factors and it's no wonder that manufacturers are actively examining the sustainability of their manufacturing processes and urgently looking for new ways to reduce their consumption of natural resources like gas, electricity and water.

But it's not always obvious how best to reduce resource consumption during manufacture without affecting the final product quality. This article recommends an approach to investigate your manufacturing process and unlock sustainability improvements, focusing not on the resources that end up as ingredients or materials in the final product, but those used for heating, washing and other processes.

## More sustainable manufacturing

The motivation for manufacturers to increase sustainability is generally for two reasons:

- To help reduce environmental impact either from carbon emissions or by-products such as waste water. As the world faces the challenge of drastically reducing emissions and consumption of natural resources, manufacturers need to play their part.
- To counteract increasing operating costs for energy, water, or other consumables.

Many manufacturers have set themselves tough challenges to reduce natural resource consumption, driven by one or both of the two factors above. But the relative importance of each factor depends on the situation in question:

- Environmentally driven: where the aim is often to reduce resource use as cheaply and quickly as possible. Though the emphasis is to achieve genuine results, manufacturers will still be cost sensitive and desire minimal impact to the bottom line. This means that any process changes shouldn't decrease throughput or increase scrap rates, though one-off CAPEX costs might be acceptable.

- Operating cost-driven: where the benefits of reductions in these situations are simpler to judge, given that cost is easier to account for. But the environmental impact is a useful by-product for corporate social responsibility and marketing purposes, although it is a less tangible benefit.

As manufacturing consultants, 42 Technology has worked with several FMCG brands who have revisited sustainability initiatives over time with an evolving justification. On one recent project for a widely successful consumer product, the focus several years ago was to achieve a purely environmental improvement without any expenditure. But now, in the face of urgent consumer pressure, there is a larger budget for more significant process alterations. And the recent rise in energy prices has only compounded this, reducing the payback period for expensive improvements and resurrecting options that were once unviable but are now worth investment.

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## Unlocking resource savings

When it comes to identifying where reductions can be made, the most obvious step is to tweak the process parameters without making changes to the higher-level process steps or equipment setup. But for most established processes, this evolutionary approach is likely to only yield small improvements. The optimum situation might have already been reached for many mature production processes or has been limited by the technologies used.

Going a step further to unlock significant savings requires a different mindset where it's important to approach the problem in a more analytical and structured manner.

## Understanding current process

First you need to know exactly where and how resources are used. It's important to acknowledge any preconceptions you may have about how your manufacturing process operates, how resources are used, whether any can be reused, and most importantly: what parts of the process can and can't be changed. Making sure you're approaching the task with an open mind, otherwise you might overlook good solutions.

The next step is to work your way through the process from start to end, noting where, and crucially, how resources are used. For example:

photo: RomboStudio/Shutterstock

photo: Ayesha Firdaus/Unsplash

- Electricity is commonly used for heating and cooling, general machinery operation, and for motion or transport.
- Gas is used for more cost-effective, high-power heating, but also increases local absolute humidity when burnt.
- Water can be used for adding, removing, or transferring heat, washing ingredients or equipment, diluting chemicals, and for transporting solids in pipes.
- Air, which can be considered as a natural resource, often incurs some expense to control its temperature or humidity.

Be wary that when reviewing each process step, ideas for obvious process changes will inevitably stand out. But while these often seem like a great local solution, thinking at the system level might uncover the opportunity for even more impressive gains. One example we have seen in a food industry process, was where the product was cooled, then much later heated. The best option was at the system level: a heat exchanger linking both steps.

To avoid missing these system-level gains, especially for areas such as heating and cooling, construct a flow diagram of the entire process to show the resource flows at each process step. For resources like water or controlled air, this diagram makes a great springboard for inspiring powerful ideas such as rerouting flows of waste air/water to other process steps where requirements are looser.

## Understanding resource use

It may appear obvious how a resource is used, but if you overlook any secondary functions, then you risk unanticipated consequences with any work to reduce resource consumption.

Two examples of 'dual purpose' resources we have experienced are:

- **Gas – for heat and humidity**

If you're using gas for direct heating within an enclosed setting, remember that the combustion will add water vapor to the surrounding air.

If you solve the heating problem (for example by installing electrical heating elements) then you should verify the impact that lower humidity air will have and increase it if needed.

This may be especially important in some food production processes, such as baked goods that are cooked in open moulds over flames.

- **Water – for washing and thermal transfer**

If water is used for washing ingredients to remove contaminants, it will also act as a heat exchanger, heating or cooling the ingredients as the water flows past. It may be easy to miss that you're currently relying on this action to get ingredients to a suitable temperature for a downstream process step.

So, if you manage to somehow make cleaning more efficient, you'll also need to make sure that the rest of your process can tolerate colder/hotter ingredients, otherwise you may have to add more water back in to fix the process.

## Generating ideas

Once you understand the resource use throughout your process, you can build up a menu of ideas with a range of potential savings. Initial analysis or lab testing will let you assign estimates for costs and benefits to each of these.

Your list is likely to range from cheap, simple optimizations (e.g. adding insulation and reducing heating power) to more complex redesigns (e.g. upgrading the least efficient part of the process) or complete system changes (e.g. linking separate process steps to reuse waste heat or water).

## Selecting the best ideas

Few improvement initiatives can be made without securing budget or buy-in from within the business. A sensible development plan is crucial to getting this buy-in, including an estimation of the risks of the leading ideas, and how they will benefit the manufacturer's sustainability objectives of either reducing operating costs or environmental impact.

photo: Marco Ossino/Shutterstock

Selecting the best ideas for further development does not necessarily mean selecting the ideas with the highest potential resource savings as these might be risky with obstacles obvious to the team. Instead, less risky 'lower hanging fruit' ideas might be the best way to go. It all depends on the specific circumstances.

## Top tips for improvements

The issues discussed above are all fairly obvious when you take a step back, but all too often we have seen otherwise well-intentioned sustainability initiatives miss key solutions and deliver limited results for entirely avoidable reasons.

If you are planning a sustainability initiative, it's worth considering the following top tips:

1. Be clear about why you are aiming to reduce resource consumption – for environmental reasons or as a cost-reduction measure?
2. Understand exactly how resources are being used in your current process. Gas and water in food and drink manufacture can have a surprising number of uses.
3. Generate a selection of optimization ideas and analyze their benefits. Which best suits your business case – inexpensive small mitigations or high development redesigns with huge potential?

Although the steps outlined above won't take you all the way towards your sustainability goals, following a systematic process from the start will put you in the best place to make changes and to unlock genuine improvements. fmt

The Author:

Simon Copley is a senior manufacturing consultant at 42 Technology, a UK-based product development and engineering consultancy, that works with some of the world's leading FMCG brands including JDE, Pepsico, Barry Callebaut and P&G.


**Issue 5/2022**

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# Food Safety Takes Priority in Design

*by Matt Hale*

**Modern food production systems have reduced the cost of foods and made them more available, but general trends towards the centralization of food supply also increases the opportunity that food safety issues, such as contamination with pathogens or toxins will affect large numbers of people[1]. To prevent this, food producers implement strict systems such as Hazard Analysis Critical Control Points (HACCP), but the design and manufacturing standards of food processing equipment are also of vital importance.**

## Types of contamination

The contamination of food and drink products can cause anything from minor quality issues to severe health outcomes and even death. There are four main types of contamination which can affect food and drink products: microbial, chemical, physical and allergenic.

Microbial contamination is caused by microorganisms such as bacteria, viruses, mould, fungi and toxins like campylobacter, salmonella and E. coli, and microbial contamination is the most common source of food poisoning. Control measures include strict hygiene measures, ensuring separation between raw and cooked ingredients, and the use of techniques to reduce the microbial load in the product, such as pasteurization or sterilization.

Chemical contamination often arises from the poor control of products used for cleaning and disinfection. If chemical residues remain on food preparation or contact surfaces, or if chemicals are used in the vicinity of food and drink products, then contamination can occur. Another source of chemical contamination may be the production of primary food ingredients such as the incorrect use of pesticides and medicines on farms.

As the name suggests, physical contamination is caused by foreign objects, and can include anything from stones and pest bodies through to items of plastic or metal. Within food processing facilities, poorly maintained or badly designed equipment can itself become a source of physical contamination in the form of items such as flaking paint or loose screws. Physical contaminants may also carry harmful bacteria, increasing the overall contamination risk.

The final source of contamination is allergenic contamination, which occurs when a food which causes an allergic reaction comes into contact with another food. There are 14 recognized allergens[2], including gluten, peanuts, eggs, mustard, soy, and fish, and the reactions caused can range from mild discomfort through to fatal anaphylactic shock.

*Stainless steel should be used for the construction of food processing equipment*


## The importance of design

The food processing business adopts a range of processes and procedures to prevent these forms of contamination from occurring. These measures may include cleaning and maintenance procedures, pest control, personal hygiene, protective clothing, dress codes, etc. Many of these procedures will have been implemented as a result of Hazard Analysis Critical Control Points (HACCP) assessment of the facility and the production methods employed, but there is another equally important aspect of avoiding contamination which is not always given such a high profile: the design and construction of the food processing equipment itself.

Hygienic equipment design enhances cleanability, decreasing the risk of biological, physical and chemical contamination. In addition, equipment that is designed and constructed to meet hygienic principles is easier to maintain and reduces the risk of physical hazards[3].

Hygienic design principles encompass a range of different factors, including material choice, surface finish, and construction methods, as well as the physical design of the product – for example avoiding lips, crevices and sharp angles where cleaning chemicals or product may build up or remain after cleaning.

To facilitate cleaning underneath and around equipment, it should be elevated above the floor on legs or mounted in a frame (as is the case with HRS's skid-mounted systems).

When designing equipment, different standards may be applied to food-contact and non-contact surfaces, and surfaces which come into contact with product must generally be smooth, non-toxic, non-absorbent and resistant to corrosion. For this reason, stainless steel is a popular choice and AISI 300-series stainless steel (as specified by 3A Sanitary Standards) is used as a key material by HRS Heat Exchangers. Welding and joints are also important; continuous butt welds should be used and ground to a smooth surface, while bolts and threads used within the food contact zone must be of a hygienic design.

*Systems such as the HRS Aseptic Block pasteurizer and filler include integrated clean-in-place (CIP) systems*

It is also important to maintain the movement of fluids and materials within the equipment and connecting pipework. Maintaining flow and preventing fouling is also a key priority in heat exchanger design and is why HRS Heat Exchangers produce corrugated tube or scraped surface designs. It is also important to use closed coupled connections to equipment in order to prevent the creation of dead spots, and to ensure that where necessary, equipment can be fully drained or emptied for cleaning or product changeover. Other considerations include avoiding the use of O-ring seals in grooves, avoiding ledges around top rims, and ensuring that shafts are suitably sealed with double seals where necessary.

## Reducing waste while maintaining safety

HRS Heat Exchangers produces a wide range of equipment for use in

the food and beverage sectors, from basic tubular heat exchangers to fully integrated pasteurization/sterilization and aseptic filler systems, as well as a number of specialist products such as evaporators, ice crushers and melters, direct steam injection systems, air removal systems and pumps. All of these are hygienically designed from the start to facilitate clean operation and prevent the types of product contamination discussed above. All HRS products designed for food use meet 3A Sanitary Standards.

Furthermore, HRS equipment is particularly designed to facilitate product removal and subsequent cleaning. It has always been a challenge for food and drink businesses to implement effective and rigorous CIP regimes which meet the necessary standards in a way which minimizes the loss or degradation of saleable or useful product. One example is the HRS R Series of rotating scraped surface heat exchangers which can physically remove product without the need for traditional pigging or flushing systems.

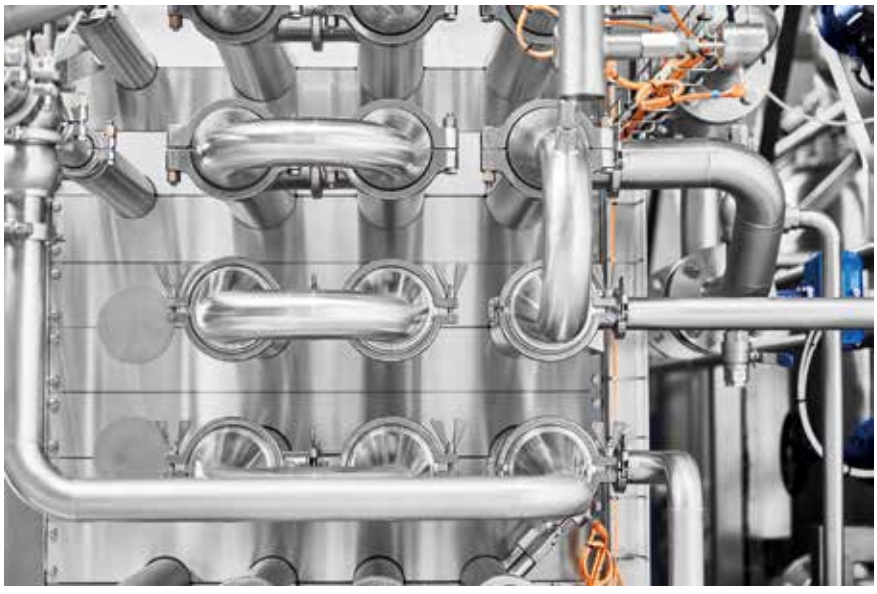
The R Series is suitable for a range of heat transfer applications and its unique design enables high viscosity products to be pumped with reduced back pressure and lower energy use. The helical spiral is fitted with scrapers – which scrape the surface of the tubes to prevent fouling in normal use – can also be run in reverse; thereby enabling valuable product to be recovered prior to routine cleaning or product changeover. This design feature means that much of the product can be removed from the HRS R Series without the need for additional pumps or pressure systems, reducing both CAPEX and OPEX.

*Avoiding contamination is a crucial aspect of food safety*

HRS also produces a Product Recovery System, which combines continual monitoring of a set parameter (for example Brix, pH or viscosity) with the three-way valve technology employed in every HRS pasteurizer or sterilizer. Working together, these two systems ensure that all product which meets the set parameters is utilized and only that which falls outside (for example, that diluted prior to or during CIP) is discarded. Furthermore, such monitoring helps to validate the effectiveness of CIP and ensures that following a cleaning cycle, only product that meets specification is allowed to proceed.

The hygienic design and construction of food processing equipment is an essential but often overlooked aspect of controlling the safety and quality of food and drink products, playing a crucial role in preventing contamination and allowing other food safety procedures to be carried out. fmt

*Food processing equipment should be designed to allow easy access for cleaning and to prevent areas where product or materials can build up*



1 Food production and food safety: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1116029/
2 https://www.highspeedtraining.co.uk/hub/four-types-contamination/
3 Food Equipment Hygienic Design: An Important Element of a Food Safety Program: https://www.food-safety.com/articles/3705-food-equipment-hygienic-design-an-important-element-of-a-food-safety-program

The Author

Matt Hale, International Sales & Marketing Director, HRS Heat Exchangers

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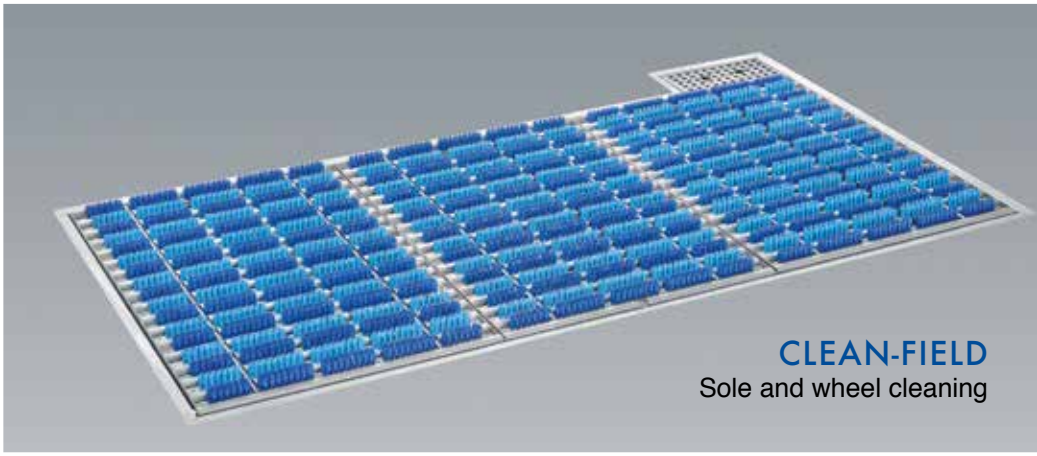

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# Spotlight on Sorting: How Modern Grading and Packing Solutions Enable Blueberry Packhouse to Gain and Retain Competitiveness

**Changes in the blueberry business are bringing new challenges to packhouses. There are now pressures to improve both quantity and quality – and solutions that make this possible. Joshua Miers- Jones, Global Category Director for Blueberries at TOMRA Food, explains.**

For blueberry businesses, this is a time of change. Global demand is climbing. Production is increasing. New growing regions are gaining market strength. And consumers' quality expectations are rising. All these changes mean that growers and packhouses must now be more productive and efficient than ever before.

Demand for fresh blueberries more than doubled in the last decade and is expected to keep on climbing in the foreseeable future at a compound annual growth rate of about 7%. One reason for this exceptional growth is the heightened popularity of healthy foods in many nations around the world. Another reason is the transformation of blueberries from a seasonal product to one that's sold all year round.

Nobody could have imagined this when a U.S. cranberry farmer first began cultivating wild highbush blueberries in New Jersey in 1908, before selling the first commercial crop eight years later. From these humble beginnings, North America became the fruit's biggest grower - but now other classes of the blueberry plant are being grown commercially, and other nations are growing blueberries in great quantities. The number of countries producing more than 10,000 tons of blueberries annually has increased since 2010 from four to eleven. The U.S. still produces the greatest volume, followed by Canada; however, China will soon be the number one domestic producer of blueberries.

Selling to domestic markets is only part of the story. What's really driving sales is exports, and that's largely due to production expanding in the Southern Hemisphere. Today the world's biggest blueberry exporter (and third-biggest grower) is Peru, followed by Chile and Mexico, with the U.S. fourth in the exporter rankings. This counter-seasonal growing in the Northern and Southern Hemispheres puts blueberries on supermarket shelves every month of the year.

## Demand for quantity and quality

Now that the availability of blueberries is expected, consumers are becoming more discerning about quality. Many now look for preferred blueberry brand names and countries of origin – and they resist buying from labels that have disappointed them. This is more than just a commodity: retailers are selling an eating experience, and it falls on growers and packhouses to provide satisfactory products.

In the quest for higher quality fruit, significant investments are being made in cultivar research. Food science is leading to blueberries that are larger, firmer, sweeter and tastier. And cultivar developers are seeking the holy grail: blueberries with a longer shelf life so more fruit arrives at export destinations in perfect condition despite spending weeks in shipping.

Quantity and quality are targets that once pulled in opposite directions. Higher throughputs at packhouses tended to imply lower product quality. Greater quality tended to require slower sorting and grading speeds and lower throughputs. But this, too, has changed. And the game-changer is technology. Today's state-of-the-art sorting, grading, and packing solutions can boost packhouse efficiencies by making the previously impossible possible.

Photos: TOMRA Food

## Optical inspecting and sorting

The world-leading manufacturer of optical inspecting, sorting and grading machines for the food industry is TOMRA Food. TOMRA is also the only integrated line provider for blueberries, offering solutions for all varieties of blueberries, fresh to frozen, and handling everything from tipping the fruit onto the line to sorting, grading, and packing. In addition to sorting by size, color, softness, bruising, decay,

dehydration, stems, peeling, and scarring, TOMRA also offers artificial intelligence for increased grading superiority across calyx, stem hole, and advanced defect detection.

TOMRA Food's blueberry solutions are scalable, making them suitable for businesses of all sizes, from small family-owned farms to multinational corporations. And because these solutions are modular, packhouse lines can grow as the business grows.

## Innovation through R&D

One reason for the effectiveness of TOMRA's packhouse solutions is the company's longstanding culture of innovation through a commitment to research and development. This includes an in- house Fruit Science Program, run from the company's Field Research Centre in Waikato, New Zealand. This boasts a production design facility, cool storage, a facility for full test simulations, engineering space, and fruit science test labs.

Another reason is TOMRA's acquisition of BBC Technologies, which originated when blueberry growers in New Zealand invented a grader and sorter that they commercialized and sold to other growers. This led to world-class expertise in precision sorting and grading systems, and punnet and clamshell filling solutions, for blueberries and other small fruits.

Yet another reason is that TOMRA's engineers have acquired a deep understanding of packhouses' operational challenges by working closely with their customers for over two decades. This working relationship is further enhanced by the fact that TOMRA is a direct-to-market provider. There's no 'middle-man' to dilute the feedback from packhouses, slow things down, or add another cost layer.

## The previously impossible is now possible

The industry-leading precision sorting and grading system for blueberries is the KATO 260. Compact, to minimize floor-space requirements, and designed to handle the fruit gently to

maximize bloom retention and shelf life, this versatile system is suitable for any fruit sorting condition. Whether sizing fruit into numerous bands or removing defective fruit, the KATO 260 provides five or seven outlets for seamless sorting in any size packing facility.

Fruit is gently loaded onto the KATO260 by an automated Tray Tipper which ensures a consistent supply and even distribution of blueberries onto the sorter, optimizing throughput. Then the KATO 260's unique rolling conveyor system singulates and rotates blueberries to allow for a complete 360- degree surface inspection. Cameras take multiple pictures of each piece of fruit, and for precision grading, the machine's software can identify defects as small as 0.2mm. What's more, this system's unrivaled guardianship of product quality is complemented by an ability to deal with great quantities: it can sort at speeds of up to 286 or 572 berries per second.

A valuable optional add-on for the KATO260 is a software and hardware package called LUCAi, which employs artificial intelligence to classify and grade fruit with unprecedented accuracy. After each piece of fruit passing along the grading line is photographed by multiple cameras, LUCAi identifies and instructs how each individual berry is to be classified. Capable of processing up to 2,400 images each second, LUCAi can also view fruit in wavelengths not visible to the human eye, seeing subtle defects such as dehydration, bruising, and early anthracnose.

Another game-changing innovation from TOMRA, launched in 2022, is the KETE16 robotic case packing technology. This versatile, high-capacity, end-of-line system automates the process of placing punnets and clamshells into cases, trays, boxes, and crates. It's flexible to punnet size, case size, and pack orientation, making changing between packs easy. No other robotic packing solution can accommodate a wide variety of pack designs at high speeds.

Automatically placing punnets and clamshells into boxes or cases has several valuable advantages. Labor is freed-up from the packing area. An undesirable contact point between line workers and the product is eliminated. And there's the certainty of delivering consistent products at speed. The KETE16 also has the advantage of picking clamshells in a way that avoids the risks inherent with suction methods, which can open lids and compromise the end product. The KETE 16 integrates seamlessly to match the speed and capacity of the

CURO-16 packing system, the fastest fill-by-weight option on the market. As its name implies, the CURO-16 has 16 filling stations. These make it capable of handling up to 200 128-gram packs of fruit per minute. The sorting line's low drops and minimal transitions ensure the fruit is handled gently as it is directed into packs.

Blueberry packers also use the CURO-8 packing system, with eight filling stations and a smaller footprint. This can handle 110 packs per minute. These machines increase productivity by reducing human handling errors and fruit give-away, and can simultaneously pack for different markets.

By adopting these various solutions, blueberry packhouses can handle large quantities while also ensuring high quality - and can take action to optimize operational efficiencies and enhance profitability. This is why there are more than 2,400 lanes of KATO260 optical sorters installed globally, why more are installed every month – and why, despite increasing competitive pressures, packhouse owners who invest in the best equipment can look to the future with confidence. fmt

# Simplifying Complex Processes

**Sustainability, safety, energy efficiency – the list of requirements when building a machine is long. When it comes to the automation of packaging systems such as FFS machines, for example, engineers need to ask themselves what the ideal solution might look like. Configuring individual components takes a lot of time. SEWEurodrive's StarterSET, however, offers a fully comprehensive automation solution that covers everything from the hardware and software to the cloud.**

*by Hans-Joachim Müller*

It's not just amateur gardeners who need green fingers – sustainability actually becomes a key focal point much earlier on in the supply chain, when their seeds are being packaged. Materials that can be recycled and composted are growing in popularity. This places special demands on the automated packaging process, during which vertical FFS (form, fill & seal) machines are used to package bulk materials such as tea. The individual steps of the fully automated process not only need to dovetail perfectly to enable high throughput, the machine also needs to be operated with maximum energy efficiency. "On top of that, we are seeing more and more sustainable paper packaging being used instead of film and foil," explains Alexander Hack, Strategic Portfolio Manager at SEWEurodrive. However, what initially sounds like a simple change presents many machine engineers with new challenges. This is because paper tears more easily than film and foil. Machines need to be able to control the packaging process very sensibly so that packaging doesn't get damaged and failures don't occur. Furthermore, the most important factor in operating FFS machines is that they provide all-round safety for both the operator and the machine.

## StarterSET makes life easier for machine engineers

Is there an easy way to meet all the relevant requirements? This is the question engineers ask themselves when it comes to automating their vertical FFS machines. Although there are plenty of solutions on the market, engineers often have to put the individual components together themselves before they can benefit from a fully comprehensive automation solution. This takes a lot of time and, ultimately, the individual components will not be perfectly coordinated end to end. It is also becoming increasingly important to incorporate packaging systems intelligently into the overall production line and to make end-to-end communication possible. This is almost impossible to achieve without an overarching solution that dovetails and communicates perfectly. That's why SEWEurodrive has developed a fully comprehensive, modular automation solution for vertical FFS machines that makes life easier for engineers. The StarterSET, which includes forming, filling and sealing automation solutions that dovetail perfectly for FFS machines, is ideal for even challenging filling processes and ensures maximum effectiveness and quality in the packaging process.

*Everything from a single source – the StarterSET significantly reduces the time needed for engineering and projects, which cuts costs for the machine builder.*

## A modular concept ready for immediate use

Hack is keen to emphasize a number of points: "It was important to us to develop a very finely cascaded modular concept. In concrete terms, this means our customers can start using the StarterSET straight away and extend it in line with their needs in an easy, flexible way. As we say, you can do everything, but you don't have to." This holistic solution includes perfectly coordinated software and hardware packages. Among other things, the StarterSET includes servomotors from the CMP50 series, matching PxG planetary servo gear units, compatible servo drives and a higher-level controller for automation and motion synchronization. It also contains coordinated I/O modules, a web-based HMI operator panel for easy machine operation and displaying the processes, plus the Movikit software modules embedded in the controller. What's more, it can be extended with complete safety modules and advanced safety functions. "Our customers don't just get the individual components – they get an entire automation solution from a single source. They therefore benefit

*The Movikit software modules are easy to start up and offer a whole host of benefits for the packaging process, including maximum seal quality, a perfect printed design and the correct web tension for the packaging material*

from SEWEurodrive's extensive expertise, excellent quality, safety and comprehensive cost savings," Hack explains.

### Parameterization instead of programming

The heart of the StarterSET is a software bundle consisting of Movikit software modules that are embedded in the controller. This machine-specific and comprehensive software package includes preprogrammed modules that can be used for everything from simple drive functions to sophisticated motion control functions. For example, the software modules in the vertical FFS machine ensure maximum seal quality, a perfect printed design on the product, the correct web tension and precise dispensing of a bulk material such as tea. These functions can be implemented within a very short time by means of parameterization and programming, since the Movikit modules are preprogrammed and, consequently, easy to start up.

"This saves our customers a lot of time and still gives them the option of making customized adaptations," Hack explains. "That's because the modules can be configured flexibly," he continues. SEWEurodrive achieves this by working with an open source code. This means application engineers can freely adapt vital aspects relating to the machine, such as customized sequences or process chains. "This is where the holistic approach of our StarterSET comes to the fore – it offers a combination of modularity and flexibility. It saves a lot of time, and

*Perfectly coordinated software and hardware packages make the StarterSET a fully comprehensive automation solution.*

*AutomationFramework: Programmed on the basis of PackML, the AutomationFramework complies with the international standard for controlling packaging machines.*


*Schlauchbeutel: Bulk material is reliably and sustainably packed into tubular bags.*

yet application engineers don't have to forgo customization," says the Strategic Portfolio Manager by way of a summary. This means developers don't need to waste time programming standard functions – instead, they can concentrate on the sequences and process chains that make up the specialist expertise of each engineer.

## AutomationFramework

The Movikit modules contained in the StarterSET can also be combined and made interdependent, thanks to the Movikit AutomationFramework software module. This state and mode manager, which has been standardized in line with Packaging Machine Language (PackML), provides a "shell" for the user program and combines the Movikit modules. What does this mean in practice? All the Movikit software modules in the AutomationFramework operate in the same state and run synchronously using a central state machine – in other words, they assume a common waiting position or start at the same time. As soon as a new software module is integrated, it also becomes a part of this synchronization. One key benefit of this is that extending and modifying the system is much easier, which saves time and money in practice.

*Precise and gentle filling, controlled by a servomotor for maximum dispensing accuracy.*

## Communication beyond machines

The AutomationFramework is also compatible with the PackML communication standard – and is open to the outside world thanks to the OPC UA server included in the bundle. The PackML standard includes the PackTag data interface for supporting end-to-end communication, which ensures that both incoming and outgoing machine data is standardized, allowing machines from different manufacturers to communicate in a line. This also makes it easy to visualize the data externally, which includes using visualization modules from different machines in one system. However, SEWEurodrive goes one step further – the software module also contains a visualization template that ensures application sequences can be checked and optimized before startup, without the need for any additional programming.

## It's the quality of the seal that matters

Where in the vertical FFS machine are the Movikit modules contained in the StarterSET used? They are used for sealing the individual product packages, for example. The sealing process needs to be of a high standard to ensure a top-quality end product. In addition to effectiveness,

*With the help of the automation technology, sustainable packaging materials can be produced with more precise regulation and control.*

seal quality is hugely important. The right temperature and the optimum pressure are decisive, as are the packaging material that is used, the format and the speed of the machine. All in all, complex closed-loop control is needed to achieve secure and reliable sealing. Processes such as this can be controlled with extremely high precision using the software modules in the Movikit AutomationFramework – even with major interference variables. For example, Movikit MultiMotion Camming controls the opening and closing of the welding tongs and the pressure for sealing the bags. The modules don't require any complicated programming and can be parameterized with ease in next to no time.

## Automation components from a single source

"By purchasing the predefinded StarterSET, our customers get a fully comprehensive SEWEurodrive automation solution with proven quality from a single source. This shortens the time needed for engineering and projects, reducing their overall costs," Hack explains. The StarterSET isn't just available for vertical FFS machines. The Bruchsal-based automation specialist also provides other machine-specific StarterSETs – from the start of a packaging line to the end-of-line. The set that the customer buys isn't final, and can be added to as and when required. Each StarterSET undergoes further advances in line with developments on the market and to fulfill specific customer requirements. Hack regards this as a cornerstone of automation for the future: "We ensure customers can build and automate their machines faster with our hardware, make them more customer specific with our software and do all that more easily with our StarterSET. As the world becomes increasingly complex, we want to make life easier for our customers with our solutions." fmt

*Alexander Hack is the Strategic Portfolio Manager at SEWEURODRIVE in Bruchsal.*

The Author:

Hans-Joachim Müller is the Market Manager at SEWEURODRIVE in Bruchsal, Germany.

# Homogeneous Conveying – a Strong Solution for More Hygiene

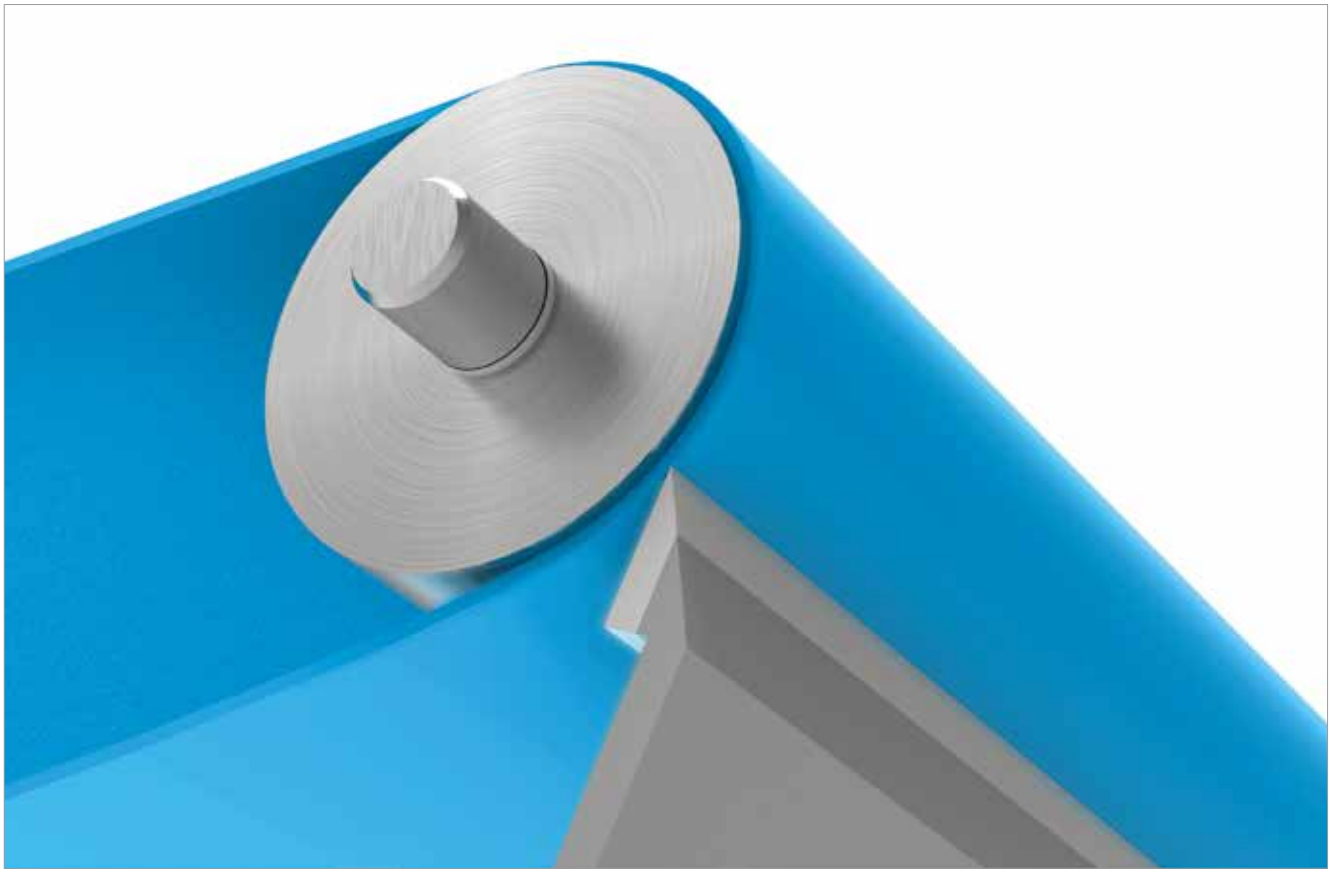
**Homogeneous belts from Forbo. For businesses that can't take risks**

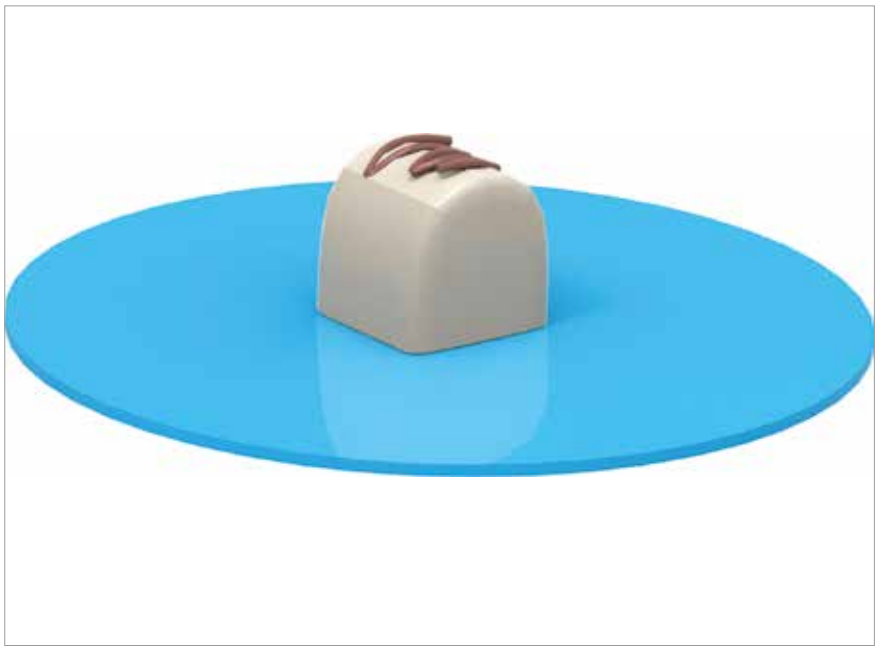
Forbo Movement Systems has added a new line for exceptionally hygiene-critical belt applications to its product range. It's offering a homogeneous conveyor and processing belt called Siegling Fullsan that's made of high-quality TPU.

In the food industry, it's in the interests of people in charge of manufacturing or processing to rule out any hygiene risk. They take every precaution to ensure compliance with hygiene regulations and HACCP concepts. Any bacteria, foreign bodies or other contaminants that enter the product could cause incalculable losses.

## Superior hygiene in conveyor belts

Homogeneous belts are indispensable, primarily because they can handle any thermal and mechanical challenges. But they are also easy to clean and can withstand any chemicals used in the process. What's more, homogeneous belts are fully sealed so that they can't be attacked by oil, grease, moisture or bacteria. As a result, they excel when used in very hygiene-critical applications.





Their superior UVC resistance also allows frequent sanitizing with UV-C radiation.

Forbo Movement Systems is now presenting the first two belts in its new Siegling Fullsan product line. The new Siegling Fullsan products currently available are from the Flat series as a reinforced Pro version (FLT+) with embedded aramid cords running lengthways. The cords increase the tensile force and minimize belt elongation at the same time. These characteristics make the belts ideal for long conveyors and heavy loads. The new belts have a matte surface for accumulation conveying or moving dry, packaged products and a shiny, easy-to-clean surface for applications involving wet/damp products.

When the belts require frequent cleaning during production, the new belts' excellent hydrolysis resistance (and therefore longer service lives) are extra benefits for users.

The reinforced FLT series' high k1% value with low elongation at fitting is another advantage. The high k1% value enables much heavier loads on the belt, compared with the non-reinforced versions widely used on the market, and exceptional dimensional stability.

Sometimes customers need to convey small items, bulk materials, very sticky products, or products up and down inclines, which can sometimes be very steep. Consequently, the demands placed on the belts vary hugely. Which is why Siegling Fullsan comes with a broad range of profiles and side walls in various shapes and sizes.

Some of the most important applications are in the meat/poultry and fish industries, as well as in the dairy product segment, all of which have stringent hygiene requirements. However, both Fullsan types can also be used in other food applications, such as dough processing or in agriculture (vegetable processing and snack manufacturing). Siegling Fullsan products comply with the current FDA and EU regulation. Therefore, they ensure outstanding levels of food safety during production and support HACCP concepts consistently.

Forbo Movement Systems is a leading manufacturer throughout the world with over 100 years of experience and a worldwide presence. It's now adding a new Siegling Fullsan line to its portfolio to cover all applications to create real added value for its customers. fmt

# The Comeback of the Century: How Stationary Retail is Changing and Adapting to a New World

**For years, online commerce has been experiencing a rapid growth. The pandemic has played a big role in this, further emphasizing the benefits of e-commerce. The demand for faster, easier, and especially contactless commerce is higher than ever. Local retailers, however, are challenging this trend. The latest technological developments in the retail sector are meeting the demand for quick and effortless shopping and defending their place as the first choice among customers.**

*by Sönke Kewitz*

Online retailing has become an indispensable part of everyday life in our society, Germany being one of the most profitable e-commerce markets in Europe. However, this development is not spreading evenly across the continent. In Sweden and Switzerland, for example, many citizens frequently purchase goods online, and yet the e-commerce growth rates are not as high as would be expected. In addition, as in all aspects in life, the pandemic has had a lasting effect on this sector. Persisting supply difficulties pose challenges for both digital and physical retail. The logistics infrastructure is reaching its limits in many places.

*1,700 of Starship Technologies' delivery robots operate daily, completing more than three million autonomous deliveries in 2021 [Quelle: Starship Technologies]*

This ranges from the lanes of delivery vehicles in dense inner-city traffic to many waterways that are now too narrow for the increasingly large container ships. This was illustrated by the container ship "Ever Given" running aground in the Suez Canal. Even after the salvage of the wrecked ship, the worldwide traffic of container ships is accumulating. Delays are occurring at Chinese ports in particular. To overcome these challenges, the physical and digital retail industry has launched a number of new developments.

## Letting groceries come to you

To serve an increasingly static customer base, so-called "dark stores" have emerged. These are distribution centers that offer online shopping exclusively and are run by app-based on-demand delivery services, such as startups Gorillas and Flink. They attract customers with the promise of delivering orders in urban areas in less than 30 minutes. According to IGD, a consulting firm specializing in retail in the grocery sector, the market volume in Germany alone is expected to grow from an initial $1.3 billion in 2018 to $3.8 billion by 2023.

The German grocery market is highly competitive. Rewe, one of Germany's biggest food retailers, has also decided to get in on the Flink delivery service in order to stand up to rival Edeka, which is on the road with mini trucks from the Dutch startup Picnic. The new Turkish supplier Getir, which is already active in Berlin, plans to increase its delivery unit to 1,000 employees in other major German cities before the end of the year.

But Germany is not the only country where there is a growing interest in dark stores. Leading supermarkets in the U.S. are now also branching out into this promising new territory. They are opting for dark stores by deploying staff in their supermarkets to handle online orders and deliveries and converting smaller stores into exclusively online distribution centers. Walmart, for example, employs thousands of "personal shoppers" who are required to undergo a three-week training program to learn how to select the freshest products for online shoppers.

## Foolproof shopping

A good indication of how things are developing in virtual and now physical retail are Amazon's innovations. The first major development was Amazon's entry into stationary retail and the introduction of Just Walk Out technology, which allows customers to avoid the most unpleasant aspect of the shopping experience – standing in line, putting goods on the conveyor belt, scanning and paying.

In the physical Amazon stores, this process is designed to be as simple as possible. Therefore, customers scan a QR code in the Amazon app or a credit or debit card linked to the Amazon account at the entrance. Weight sensors and cameras located throughout the store are used to closely monitor the customer's activity. When a customer decides to purchase a product and takes it off the shelf, the item automatically ends up in their digital shopping cart. The shopper can then simply leave the store and the product will be

automatically billed. In March 2021, Amazon opened the first of these cashierless supermarkets outside the USA in Ealing, London, under the name “Amazon Fresh”.

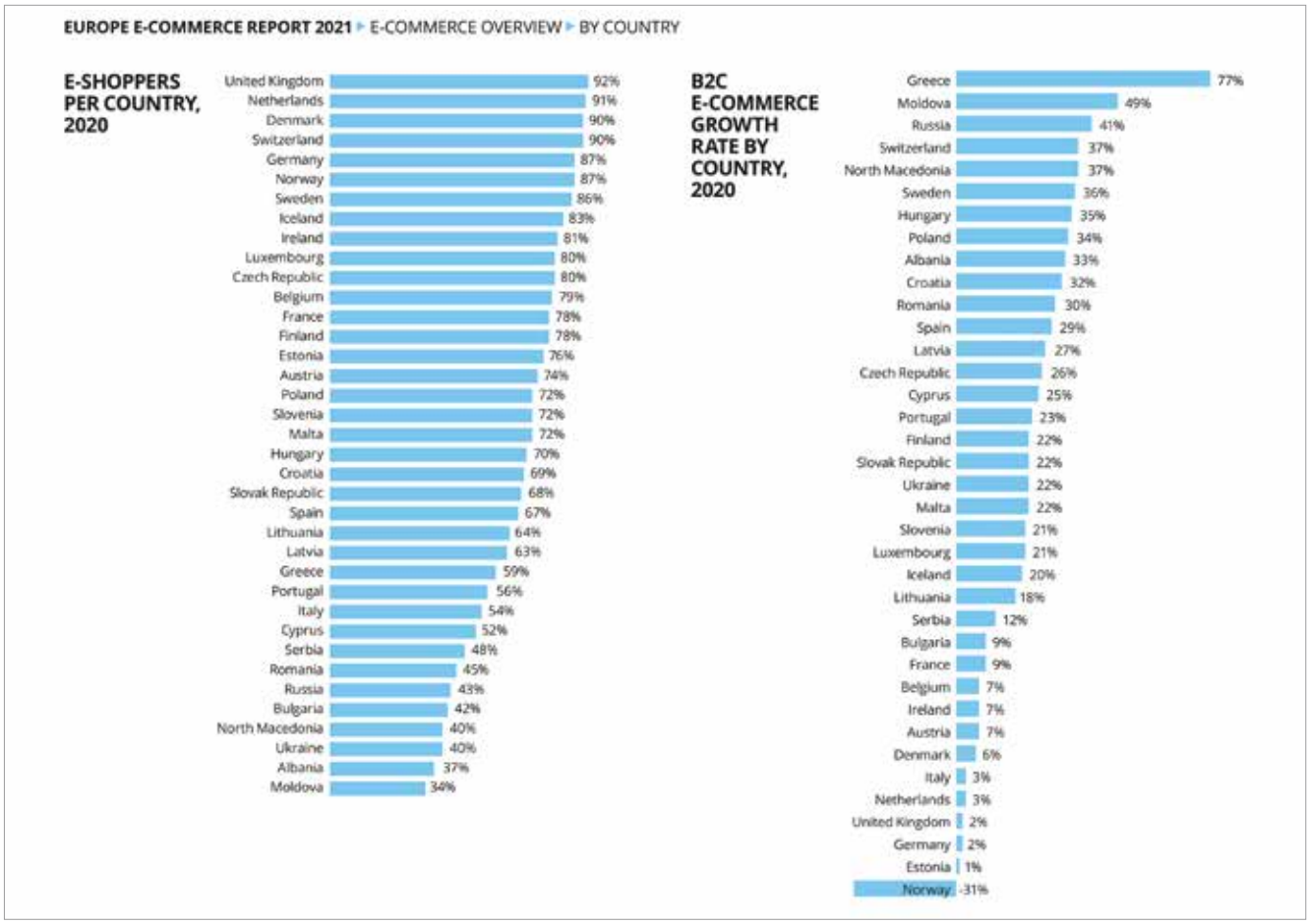
The idea of cashierless supermarkets has prompted other food retailers to follow this example. Tesco also opened its first “GetGo” store in London in 2021, while Albert Heijn experimented with its cashierless tap-and-go concept in Western Europe. That year, Amazon also introduced Amazon One, a biometric payment service that allows shoppers to pay for goods with their bare hands. Combined with Just Walk Out technology, Amazon Prime members who are subscribed to Amazon One can walk into any Amazon store and make purchases with a simple hand gesture.

*Asian countries pave the way for cashless payments [Quelle: Amazon]*

## The more the merrier

The automation of dark stores and algorithmic optimization of local inventory will be of significant importance. Retailers will rely on machine learning to model the complexity of demand fluctuations. They will use shelf scanning technologies to detect empty shelves and misplaced items. In the same way, retailers in logistics centers, like the ones at P3 Logistic Parks, will use automated warehouse solutions to speed up the stock-picking process. The cashier and touch-free shopping experience will increase significantly, and many grocery stores will convert their facilities so that customers can take advantage of the just-walk-out technology.

*Rising e-commerce trend was accelerated through the pandemic [Quelle: 2021 European E-commerce Report]*



These experiments and pilot projects are already getting started in Germany, as well. In Heilbronn, the Schwarz Group is currently testing a model whose mode of operation strongly resembles that of Amazon Fresh: a convenience store under the name "shop.box". Edeka has likewise launched a similar service in cooperation with Deutsche Bahn at the train station in Renningen. Aldi also opened its first store with no checkout at the beginning of 2022, but only in London for the time being. Rewe is going its own way and since the end of 2021 has been the first company to offer its customers in the German food retail sector a hybrid shopping model: Classic payment at the checkout or innovative, without a checkout process, using the Pick&Go app, which customers can use to register at the innovative entry counter. The bill is displayed and paid later on the app.

More and more stores will act as pure logistics distribution centers to handle online deliveries, returns and click-and-collect orders. Street robots like Starship's delivery robots will gradually become a familiar sight on sidewalks in Western European cities. At the end of 2021, Starship announced that its robots had made two million deliveries, and the company also partnered with UK grocery retailer Co-Op to deliver goods to customers across the UK.

Biometric payment systems will also spread outside the U.S. and China and gain popularity in Western European stores in particular. According to the survey institute Vanson Bourne, more than 40 percent of German survey participants wanted this technology for a more pleasant shopping experience in 2019. Hand, fingerprint or facial recognition are therefore pushing mobile payments into second place. In Eastern Europe, on the other hand, the acceptance rate is expected to be low, as people in that region are particularly cautious when it comes to communicating personal data. However, the introduction of globally valid digital vaccination passports will accelerate the adoption of biometric payment systems as people become accustomed to progressively trading privacy for convenience.

Blockchain technologies will also become mainstream. These are barcodes that are linked online and offline to certificates that are issued digitally by independent certification and auditing companies, proving that goods have been produced ethically and sustainably, including the amount of $CO_2$ emissions in the supply chain.

## More personal than ever

A look at China provides a practical understanding of the technological future of retail. At Alibaba's Hema stores, the entire physical shopping experience is connected to the Hema app on mobile, allowing personalized deals and special offers to be sent to customers as they walk through the store. Hema stores also use facial recognition payment systems, have a robotic restaurant on site, and use blockchain-based product labeling that changes prices in real time. In addition, consumers can view the product's origin, date of manufacture, and date of arrival at the store. Further, there are chefs in the supermarket that prepare a meal from the purchased food and an on-site distribution center that delivers all purchased products within a three-kilometer radius to customers' homes.

As we look to the future of retail, one conclusion can be drawn, regardless of the trends going back-and-forth between stationary and online retail: For any business to prosper, customers need a personalized shopping experience and retailers must enable customers to shop as seamlessly and uninterrupted as possible. This offer can be achieved by uniting the digital and physical identity of shoppers in a single customer profile to reach customers in the right places and through the right channels.

The results of these measures would lead to increased customer loyalty and local businesses who can remain competitive and relevant despite the ever-changing digital landscape – clearly a win-win situation for all involved. As customer satisfaction is ensured because personalized offers allow customers to make as little effort as possible all while still getting exactly the goods they need and local retailers do not have to worry about the future of their profession. fmt

The Author

Sönke Kewitz is CEO of P3 Logistic Parks Germany

1) https://ecommerce-europe.eu/wp-content/uploads/2021/09/2021-European-E-commerce-Report-LIGHT-VERSION.pdf
2) https://www.igd.com/articles/article-viewer/t/leading-global-online-grocery-markets-to-create-a-227bn-growth-opportunity-by-2023/i/20396
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5) https://www.supermarktblog.com/2021/03/11/schwarz-gruppe-testet-kassenlose-minimaerkte-shop-box-und-collect-box-in-heilbronn/6) https://www.rewe-group.com/de/presse-und-medien/newsroom/stories/kassenloser-einkauf-rewe-bietet-in-erstem-markt-pick-and-go-an/
7) https://www.gfm-nachrichten.de/allgemein/deutschland-biometrische-bezahlung-populaerer-als-mobile-payment/

# Food & Beverage Industry in Northern Portugal – Cooperation with Germany

Within the scope of the "Qualify. Teca" project, developed by the Business Association of Agueda AEA in cooperation with the Business Association of the Municipality of Oliveira de Azeméis (AECOA), for the 'Equipment, Services and Ingredients for the Food Industry' sector, **Ian Healey** joined **Cyriacus Schultze**, international food and wine expert, in Northern Portugal. The two associations have a joint mission to promote the aggregation of and the recognition of the 'Equipment, Services and Ingredients for the Food Industry' sector, regionally, nationally and internationally, as a major cluster for the Portuguese economy, within the scope of Portugal 2020 and specifically of the Support System for Collective Actions (SIAC) – Qualification, and included in thematic objective nº 3 – "Reinforce the Competitiveness of SMEs" of the Competitiveness and Internationalization Operational Program, supported by the European Fund for Regional Development (FEDER).

The visit was made up of meetings with various(several) local companies and an introduction to their different fields of expertise, all involved with the international food industry and interested in extending their export potential.

*The seminar organizers were very satisfied, including Angela Amorim, AECOA (c) and Patrícia GonÇalves, AEA (r)*

At the heart of this mission was a seminar focussing on Germany and the specific challenges to reaching into this market.

The Keynote address from Cyriacus Schultze, President of Food and Wine Culture Business Consultants was very well received by an enthusiastic audience. The comprehensive subject matter was divided into three chapters:

- Selling in Germany
- Market entry strategies
- Leading trade fairs in Germany

*Cyriacus Schultze (r) held the Keynote speech during the seminar and workshop*

## Selling in Germany

- Introduction to the German food and beverage (F&B) sector
- German business manners and cultural differences to other EU countries
- Language barriers, dresscode, mindset
- Banks and payment systems
- Backbone of the economy: The German "middle class"
- Decision makers, B2B sales structures, hierarchies and working ethics
- Particularities and expectations towards foreign companies, that want to export to Germany
- Different regions in Germany (geographical, political, businesswise)
- The F&B industry: Salesforce, key facts & figures, statistics and numbers

## Market entry strategies

- Local market dynamics
- Growth markets
- Enabling your business to trade in Germany
- How to develop a bespoke entry strategy
- Market research, analysis and identification

*Visit to Fajota in Águeda*

*Visit to Marsil inox in Vale de Cambra, welcome by Franciso Fernandes, (r), Commercial Director*

- Blue Ocean Strategies
- Options or next steps if you already have a local sales rep, agent or office in Germany

## Leading trade shows and exhibitions

- Finding your spot and the "right" business partners
- The most relevant trade shows for your company
- Booth design and size
- Directories and links
- Accompanying advertising activities and promotions
- Alternatives to trade shows: Specialty magazines, internet, social media

Ian Healey underlined the importance of finding the right trade show for the target market and introduced some of the current trade magazines available, explaining the similarities and differences between them. Advertising has developed from the traditional print options and digital promotion has become ... a realistic and cost-efffective addition for a supplementary marketing strategy.

AEA's goal, together with AECOA, is to bring companies from Portugal more strongly into the German and other markets and in doing so, to support industries in their export growth.

The companies visted included:

- Ramalhos - Highest Quality Industrial Ovens.
- Fajota - Hardware and Components for the Refrigeration Industry.
- Vista Alegre - Specialist Porcelain Factory
- Marsil inox. - Service Provider in Equipment Manufacturing Industry, including Laser Cutting and Robotic Welding
- EUMEL - A Metalomechanic Company in several branches including plastic injection molding and stainless steel accessory processing

*Visit to Ramalhos in Águeda, meeting with Catarina Sucena, Export Manager*

*Meeting with EUMEL, Rosélla GonÇalves, Commercial Director, (2nd from right)*


*Visit to Equiproin in Ossala, meeting and tour with José Ribeiro, President (3rd from right)*


*António Pinto Moreira, President of AECOA (l) and Miguel Coelho, President AEA (c) hosted the three day event.*

- Equiproin - Designer and manufacturer of stainless steel products for wine, beer and other industries
- Metalogonde Indústria Metalomecânica - A leading company in the handling of solid and liquid raw materials in bulk. Designer and builder of industrial facilities for the storage and processing of powdered, granulated and liquid products.
- BTL Indústrias Metalúrgicas - A company specialized in the development of projects and tailor-made solutions for industry, specializing in engineering , acquisition , design and construction of integrated systems , equipment and "turnkey" solutions.
- Gofil - Goncalves e Filhos, Bottling and Corking Machinery

It was a fantastic experience to be a part of this event, especially the warm welcomes during the visits to so many different and qualified companies in their own fields, as well as to join in the workshop for the main players of the Food & Beverage Industry in Portugal and to talk about developments in the food trade and export opportunities for these companies.

Thanks especially to Cyriacus and Patrícia for the excellent teamwork. fmt

***Ian Healey***

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# Ceylon Cinnamon and Pepper: Aromatic Spice Specialties

**Sri Lanka is famous for its spices. It is the home of cinnamon, pepper, cloves, cardamom, nutmeg and vanilla. But the tropical climate also supports cultivation of curry leaves, lemongrass, ginger, turmeric and many more products renowned for their good Flavor. In addition, many spices are also valued for their health benefits or used as fragrances. The trade with cinnamon and pepper has a long tradition in Sri Lanka and today these products are still in demand on international markets: Ceylon cinnamon and Ceylon pepper are distinguished by their taste as well as their constituents and are vastly different from the products of the same name grown in other countries. The Import Promotion Desk (IPD), a project of the German Federal Ministry for Economic Cooperation and Development, has been involved in Sri Lanka since 2018, preparing small and medium-sized enterprises for the European market. Among them are many producers of organic cinnamon and pepper.**

## Ceylon cinnamon vs. cassia cinnamon

Ceylon cinnamon is often referred to as the true cinnamon compared to cassia cinnamon. The spices differ in origin, production, coumarin content and flavor. Ceylon cinnamon is obtained in Sri Lanka from the bark of the cinnamon tree (Cinnamomum zeylanicum) native to the island. It contains high levels of antioxidants, secondary plant compounds and essential oils - but hardly any coumarin. Coumarin is found mainly in Chinese cinnamon, cassia cinnamon (Cinnamomum cassia), and can be harmful to health in larger quantities. For production, the bark is removed from the branches and the underlying inner bark shaved off in layers. As it dries, the bark then rolls up on its own. For cassia cinnamon fairly thick bark is used, whereas for Ceylon cinnamon many thin layers of bark are added to form the cinnamon stick. The constituents and the production methods influence the aroma. In terms of taste, the two types of cinnamon therefore differ significantly from each other. The higher quality Ceylon cinnamon has a more delicate and less pungent aroma than cassia cinnamon.

## Production of cinnamon sticks

Ceylon cinnamon sticks consist of several very finely cut pieces of inner bark from the cinnamon tree, pushed into each other. The peeling of the cinnamon branches is done by hand. In Sri Lanka, cinnamon production is often a family tradition and the craftwork skills are passed down from generation to generation. At the IPD company “Savour Route”, 90 percent of the team is made up of women. They are experts at processing the branches and finely planing the inner bark. Many of the female employees have been working in the cinnamon industry for many years and have refined their techniques over time. As specialists in Ceylon cinnamon production, they are well paid and many of them are breadwinners for their families. The finer the layers, the better the taste of Ceylon cinnamon. After cutting, several layers are placed over and inside each other, the fresh bark automatically rolls up from both sides and cinnamon sticks are formed. In cross-section, a Ceylon cinnamon stick with its many layers resembles a cigar. Ceylon cinnamon sticks are offered in different qualities - depending on the diameter of the sticks. The thinner the sticks and the finer the different layers, the higher the quality. The highest quality grade “Alba” indicates sticks with a diameter of 6 mm.

## Trademark “Ceylon Spices”

Before Sri Lanka became independent and a republic in 1972, the island bore the name Ceylon. The name is still used for the famous tea and spices to indicate the special quality of the products. The “Ceylon Spices” trademark from the Sri Lanka Export Development Board (EDB), a partner of IPD in Sri Lanka, identifies cinnamon, pepper, cloves and other spices that are 100 percent grown, produced and packaged in Sri Lanka. This year, the European Union granted Ceylon cinnamon geographical indication (GI) status. This seal documents Ceylon cinnamon’s association with Sri Lanka and specifies that the raw material for Ceylon cinnamon must come from Sri Lanka.

## Cinnamon oil flavoring

For the European market, cinnamon is almost always ground. It is mainly used for desserts and pastries, less often for savory dishes. The chips are also used to extract cinnamon oil, which is used as a flavoring or fragrance in the food and perfume industries. This cinnamon bark oil has a high content of cinnamaldehyde, which gives cinnamon its distinctive fragrance. IPD companies obtain it by steam distillation. They also produce a cinnamon leaf oil whose main components are also eugenol and cinnamaldehyde, but eugenol, known as clove essential oil, predominates in cinnamon leaf oil. Both oils are also used as remedies and are said to have a warming effect as well as anti-inflammatory properties.

## Sri Lanka and the international spice market

Cinnamon was one of the first spices traded in the ancient world. Arab traders brought cinnamon from Sri Lanka to Europe via the spice route. Other spices such as pepper, nutmeg and cloves from Sri Lanka have also been in demand around the world for centuries. Today, Sri Lanka exports about 30,000 tons of various spices annually.

Spice production in Sri Lanka is in the hands of small farmers. More than 70 percent of the cultivated land is managed in small farms and home gardens. The IPD supports small and medium-sized enterprises that process the products of small farmers for export to the European market. For example, the company “Pasanka” from the IPD programme works with 60 small farmers.

## Ceylon pepper with high piperine content

Due to the proximity to the equator and the tropical climate, many different spices grow in Sri Lanka. Ceylon pepper is the second most important raw material among spices after Ceylon cinnamon. It differs from other pepper varieties and countries of origin in its high piperine content (7 to 15 percent). Its particular pungency makes it exceptional. The flavor of Sri Lankan black pepper is richly aromatic, with floral and citrus notes, while maintaining a strong pungency. The flavor only really comes through when the grains are freshly ground. Pre-ground pepper quickly loses its volatile oils and thus its flavor characteristics.

## Production of Ceylon pepper

Ceylon pepper comes from the pepper bush (Piper nigrum), which is cultivated on an area of 32,800 hectares in Sri Lanka. Depending on the time of harvest and further processing, there are different types of pepper, such as green, red, white and black. For the classic black pepper, the berries of the Piper nigrum are harvested when they are green and not yet fully ripe. Then they are blanched and dried in the sun, producing peppercorns with a high essential oil content. The black color results from the oxidation that takes place during drying.

## High quality spices in organic quality

In Sri Lanka, the development of organic agriculture is of great importance. One of the country’s goals is to convert the industry to 100 percent organic. Already today, the well-known Ceylon spices are mostly offered in organic quality - a special feature on the spice market. The companies “Verger Naturals” and “SDS Spices”, which the IPD has been accompanying since 2019, offer their entire range of spices with international organic certifications - including cinnamon, black and white pepper, cloves, nutmeg and mace. fmt

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