

# Squeezing more from extruders

A new generation of 'baked' snacks serves to demonstrate the versatility of extrusion. But fried products also benefit from an increasingly modular approach to machine design, argues Paul Gander.

■ THE use of extrusion systems for snack products is hardly new. To take just one example, John Eshelman, director of pretzel and snack machinery sales at Reading Bakery Systems (RBS) in the US, points out that the first continuous low-pressure system equipped with cutters was developed for pretzel manufacture back in the late 1950s.

So what is the enduring attraction of this technology? And what gives it such an apparently convincing future role in the industry?

Flexibility and adaptability seem to be key considerations here. Extrusion cuts across product categories, opening up all sorts of opportunities for 'cross-fertilisation': an ounce of imagination can turn a filled breakfast cereal or a crouton into a savoury snack. And the number of technical variables, both within the extrusion unit itself and either side of it, means that there is always a new twist on an old format around the corner.



Above: Pavan's G55 cooker-extruder



## Modular machinery

Machinery manufacturers have accentuated this basic adaptability by taking a consciously modular approach to system design. At Pavan in Italy, for instance, R&D director Luciano Mondardini highlights the options available for machinery features such as screw configuration, barrel length, and dosing and mixing systems. "We also offer modular units for pre- and post-extrusion operations in many of our food processing systems," he says. "These provide our clients with greater flexibility, easier maintenance and more room to manoeuvre in processing."

That 'room to manoeuvre' is increasingly about future-proofing a new production line. At Baker Perkins, marketing manager Keith Graham explains how modular line evolution can support development in a customer's product range. "The standard level would be direct expanded snacks such as corn curls or rings, with an extruder, drier and some sort of coating or seasoning system," he says. "The next level could be to put in a cutter for products such as chip sticks. The product would be a similar texture, but with a cutter between the extruder and drier."

Croutons, produced using a different cutter, might be the next stage. "Then pillow-type products could be introduced, 3D shapes put through a cut-and-crimp process, perhaps using more interesting ingredients," says Graham. "Then you're getting into co-extrusion, filling the outer shape through a separate feed, with the option of a subsequent cooling system."

## Crazy about croutons?

With the current emphasis on healthier - especially baked - snacks, the type of crouton that Graham mentions has been picked up by several equipment suppliers, many of them offering a module to match.

Anne-Sophie Le Corre, new product development manager at Clextral, explains the company's range of post-extrusion Clip-On modules and the options available in this specific product area. "Recently, we developed a new crouton cutter that cuts at a 90-degree or 45-degree angle, giving customers the ability to extend their product lines from large, round soup croutons to small, square croutons or snack-type croutons," she says. "They can be made from whole grains, and with lower sodium and fat contents."

This interest in croutons is only one of the more recent examples of a broader trend in extrusion to take complex, multi-stage 'baked goods' processes, simplify and compress them. Typically, it is not only factory floor footprint which is reduced, but also cost.

These savings are often reflected in processing times. Says Le Corre: "While traditionally, bakery manufacturers may need up to four hours to produce croutons, twin-screw extrusion technology allows them to produce the same quality product in less than 30 minutes."

As a further example of process streamlining, Graham at Baker Perkins cites extrusion sheeting, as a "significantly simplified" version of the traditional bakery sheeting line. "By using an extruder, the mixing, sheeting and gauging are all combined into a single operation," he says.

Extrusion also provides solutions at the level of individual products. Pavan's Mondardini points to one such success, though a confidentiality agreement means he cannot name the branded snack in question. "We substituted a battered, partially fermented wheat-based dough, produced through a long and complicated process, with a simple single passage in a specially-designed, low-shear, twin-screw machine in our KTT series. It permitted continuity in the operation, shortened the total processing time and meant the customer obtained a perfect product match."

## Extrusion meets baked trend

Pavan's mystery product may be an established one, but industry demand for a new wave of 'baked' products is also to a great extent being met by extrusion. This is especially good news for a baked goods specialist such as RBS. "We're seeing an upsurge in demand for baked snacks machinery," says Eshelman. "The US government has gone after obesity, with companies being asked to offer more sensible snacking options."

The 'free-from' market is also booming, he says, particularly in Europe. Gluten-free alternatives to wheat-based products can be extruded using the same low-pressure systems, according to RBS. But the particular characteristics of the corn or



Above: snacks produced on Pavan's equipment



Above: chips produced on American Extrusion International's extruders

potato-based mass, combined with food starch as a binder, requires prefeed rollers to guide it from the hopper into the extruder.

However, in the world of snacks, the better-for-you market segment rarely tells the whole story, and fried products remain as popular as ever. "Our equipment is used for the Hula-Hoop type products, popular in the UK and other parts of Europe, which are extruded, cut and dropped into a frier," says Eshelman. "Oddly enough, it's a product that's never really taken off in the US."

Noodles are another key component in fried snack mixes, particularly on the Indian subcontinent. "We supply equipment to all the major manufacturers in India," says Eshelman.

Like RBS, fellow US supplier American Extrusion International (AEI) has made allowances in some of its more recent systems for new ingredients and the ways in which they need to be fed into the extruder. "We have a new vibratory 'Live Bottom Hopper', which allows for more floury material to be used in the extruder," says marketing director Diane Warner. "Benefits include the ability to source cheaper materials and use recipes with more



ingredients, such as multi-grain mixes."

But AEI is another equipment company which keeps as close to the fried snacks market as it does to healthier positionings. "We recently launched our Super Capacity Fry Type Extruder, which produces 590kg of collets an hour, before seasoning," Warner adds. "This patent-pending extruder is available with a touchscreen, which controls all quality and production parameters."

## Adding value post-extrusion

As we have seen, in many cases, extrusion compresses and simplifies operations which would otherwise be far more complex. And yet the processes before the extruder indeed and after the cutting system will often make a critical contribution to final product quality.

At Dutch company Lalesse Extrusion, general manager Hendrik Jan Mekelenkamp sets the extruder in the context of the overall line. Lalesse offers an automatic buffer system, with one mix lasting three hours, in its mixer-feeder-extruder configuration. On the far side of the extruder, there is an online slurry system feeding the coating drum, which he describes as being "too simple to be true".

The company also offers a choice of rotary driers with high-power, steel tube infrared elements or alternatively belt driers with hot air circulation. "Belt drying is a very energy-efficient method," Mekelenkamp says. "The largest drier will handle some two tonnes an hour. They are now PLC controlled and very simple to operate."

The version of its extruder with a direct drive (replacing a motor, V-belt and bearing housing) offers higher-pressure extrusion and twice the amount of torque, says Mekelenkamp. Lalesse says it sold 25 of these direct-drive systems in the three years to January 2011.

Pavan likewise emphasises the importance of drying among the various post-extrusion operations. "It can be a long process for snack pellets or a very short drying process for direct-expanded snacks," says Mondardini.

In general terms, says Pavan, the many pre- and post-extrusion treatment options are playing an even fuller role in today's snacks market. "Most of the newly-developed products have required the

intensive use of these treatments, to the point where we have been adding these options to older lines to reconvert them for new product manufacture,” Mondardini reports.

### Pre-extrusion possibilities

He puts dry and wet mixing, multiple micro-ingredient dosage points and pre-steaming among the pre-extrusion options available. “Post-extrusion, we have a very wide range of shaping possibilities for pellets and direct-expanded products after the die: sheet grooving, coupling for 3D products, sheet perforation, and so on.”

So what do these developments in the industry, and in the machinery sector which supplies it, tell us about the future? As extrusion technology matures, are we likely to see something of an innovation plateau, marked by minor enhancements rather than radical new departures?

### The shape of things to come

Cletral puts these future prospects for snacks extrusion in the context of wider industry demands. “While some market segments may require higher torque and output capabilities, like the feed industry, I think the snacks industry is really looking for healthier alternatives to traditional snacking,” says Le Corre. “This seems likely to stay as a strong trend for some time to come. Improvements still need to be made regarding ways to incorporate ‘better’ ingredients, lower fat and sodium content, while at the same time satisfying consumer taste buds.”

For its part, Baker Perkins does not rule out questions of torque and output as being irrelevant to snacks. Says Graham: “There’s going to be a wider diversity of products available in future, and that range is already broadening gradually.” This is despite the likelihood that, in many markets, total volumes of snacks - and of



**RBS says fried potato ring snacks are as popular as ever in Europe**

extruded snacks - will not grow significantly. “Flexibility and the ability to change product will become more important, as will the ability to handle a wider range of ingredients” he adds. In those instances where the mix contains less moisture, where more friction is created, where more heat is required or where the process is generally more intensive, then higher levels of torque may well be desirable.

Baker Perkins’ own SBX extruder, introduced around three years ago, offers a larger motor and gearbox, allowing higher levels of torque, he points out.

That said, Cletral could argue that it has already addressed these issues with its Evolum range, first introduced in 2000. The first systems in the range offered improved heat transfer as well as higher torque, Le Corre explains.

### Evolution or revolution?

Looking ahead, Graham at Baker Perkins says: “We’re in a period of evolution rather than revolution with extrusion, but I don’t see the market running out of steam in the future. It could well be that, in few years’ time, a new product comes along which needs an extruder with a longer barrel, more power or longer processing times.” It is not a question of ‘if’ special requirements of this sort materialise, but ‘when’, he argues.

**Below left: American Extrusion’s Advantage 50 extruder**

**Below: low pressure extrusion systems from Reading Bakery Systems**

On one level, incremental changes to the capabilities of extruders and auxiliary equipment will continue to match particular customer demands. For instance, RBS has been developing faster servo-driven cutting systems. A couple of years ago, this meant moving from under 40 cuts a minute to over 260 on its reciprocating band cutter. Now Eshelman hopes that by January next year, a 325-cuts-per-minute system will be commercially available. “There’s no one else who’s close to doing this,” he says.

To match these cutting speeds, RBS introduced its Forced Flow Finishing for in-house machined forming dies. This creates “a mirror-like finish”, says Eshelman, reducing friction and so increasing linear velocity.

On another level, it is extrusion’s ability to generate new options, as well as make existing functions more efficient, which will be key. To take the RBS example, higher output and processing speeds need not always be the goal. Mondardini at Pavan offers the teasing comment: “A lot of our development work is kept confidential. But one reflection I like to make is that ‘high-temperature, short-time’ processing, which has driven food extrusion up to now, has been thoroughly investigated. On the other hand, a lot can still be done using extruders for longer, lower-temperature processing.”

That hunger for new snack options is evident in the explanation from Le Corre of the significance of Cletral’s Clip-On modules: “Our customers are less and less mono-product. Because of the way the snack market is developing, the trend is towards low-volume production and multiple product lines.”

A continual flow of novel products is important in any packaged goods market, but it is currently of particular importance to the snacks category - and extrusion has a huge contribution to make in maintaining that flow. ■

