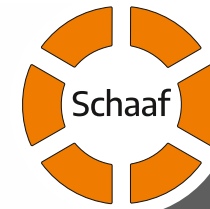




FOOD-EXTRUSION

Machines | Systems | Technology | Research | Service

...we shape the world!



Extrudates allow you to see, feel, smell, taste and even hear (!) technology.

“Show me your products and I’ll tell you which extrusion technology you’re using!”

THAT’S TECHNOLOGY

FOR THE SENSES.

DIVERSITY AND QUALITY

of our products are the benchmarks for process and machine performance





RESEARCH

& DEVELOPMENT

**There's still so much untapped potential for extrusion cooking.
As we say in the Schaaf technology centre:
"There's still lots to discover!"**

As one of the oldest methods of food preparation, cooking is a gentle preparatory process. The (TURBO) extruder can be described as a pressure cooker that protects and preserves the natural properties of raw materials.

Research and development efforts at Schaaf are entirely aimed at providing the customer with immediate and worthwhile benefits. The customer benefits from our full support – be it in developing of new products, adapting products to local preferences or in the form of technical solutions for even the most diverse extrudates. This allows the user to make attractive products in a highly efficient way with our TURBO extrusion process.

The TURBO's flexibility is particularly apparent from the freedom with which raw materials are selected. Products can thus be made economically using local sourced raw materials and adapted to country-specific tastes.

We enjoy developing new processes, recipes and shapes together with our customers with a view to continually expanding our product portfolio.



SPIRALS

Even more freedom in extruded spiral production!

For a long time, extruded spirals could only be made with a limited choice of raw materials and a small number of textures.

By developing a spiral die system, which from a technical standpoint is based on the 3D cutting method patented by Schaaf, spirals can now be manufactured in an array of textures and using a wide variety of raw materials.

By combining spiral-cutting technology with co-extrusion technology, an even wider variety of products can be made – including "spiral tubes" with delicious cheese or peanut cream fillings.

Alternatively, spiral-shaped, thin extrudates can be manufactured, with their crispy, crunchy texture making them stand out from regular, directly extruded standard products. Despite dense textures, comparatively low bulk weights and acceptable bag volumes can be achieved, with the spiral cutting technology.

...we shape the world!

SAVOURY SNACKS

Tasty textures with selected seasoning presented in attractive colours, shapes and flavours

Intended for direct consumption, crispy puffed snacks are the most common and well-known extruded products. Popular products include cheese puffs, peanut curls, potato sticks and so on.

Raw materials:

While most savoury snacks are made from corn, which is the most common raw material used for direct expanded products, other interesting raw materials such as potatoes, wheat or rice may be used too. Pulses and beans can also be used to adjust the taste to local preferences. Complementary high-fibre raw materials can also be added to increase the nutritional value in various ways.

The process can be split into three steps:

Preparation of raw materials:

Individual or multiple raw materials are pre-moisturised to a determined level with water or aqueous raw materials prior to the extrusion process. Moisturising either takes place in batches or continuously. The free-flowing, blended raw materials are volumetrically dosed into the extruder. Minor additives can also be added as an option.

Extrusion:

The mainly starch and protein-based raw materials are processed in the extruder using pressure and heat to make a cooked dough, before being expanded through a die and shaped into a pre-defined product. Schaaf TURBO extruders offer the option of controlling and inspecting the expansion

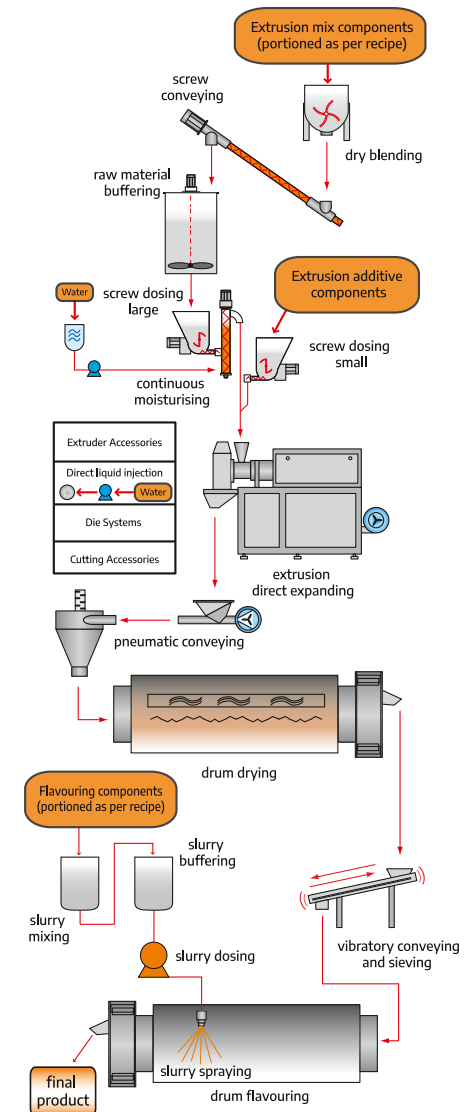
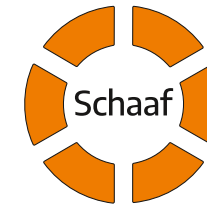
of the finished product using numerous process parameters. This variety is expanded due to the large number of available die designs.

The 3D shapes, produced using patented Schaaf technology, are very popular. Some products have their very own special characteristics in terms of colour, texture and shape, achieved using peripheral machinery available as an option.

Drying and flavouring:

Once it has been cooked in the extruder, the product is dried to a certain moisture level to make it crispy. Using an infrared drum dryer, Schaaf offers not only an efficient way of drying products, but also certain toasting and roasting effects, which can further enhance the product's flavour. After drying, the product will have a crispy texture, but still require flavouring. Fat based seasoning is spread evenly over the product to round out the taste.

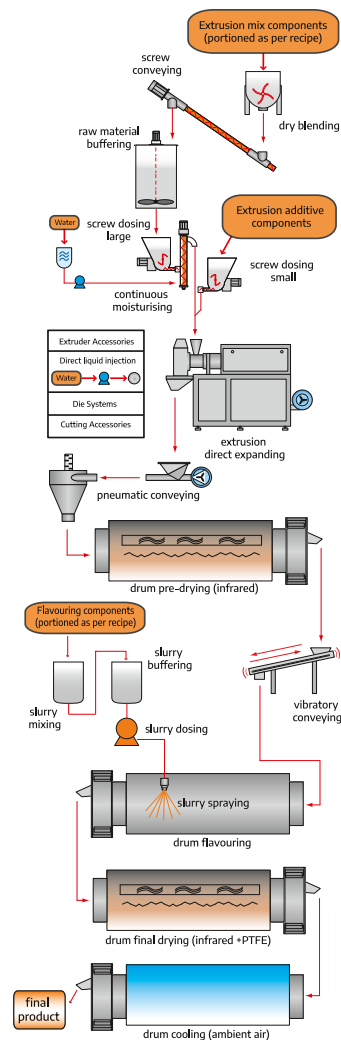
A temperature controlled two kettle system is used to prepare the coating. In the first kettle, oil and seasoning are vigorously mixed and then pumped into the storage kettle. This slurry can then be spread onto the extrudate using a dosing pump in the desired mixture ratio. The coated, ready-to-eat extrudate can then be packed immediately.



Healthy, tasty breakfast cereals “packed” in innovative shapes

These grain-based products, made with nutritional values in mind, are intended for consumption with milk, yoghurt or similar foods. Depending on market conditions, products can be sweetened or flavoured with typical ingredients such as cocoa, honey, malt and so on. Children also like to eat these breakfast cereals as a sweet snack.

A spin-off from this product group is being marketed as a granola/muesli blend. This blend mainly contains extruded products, as well as added nuts, raisins and more besides.



Raw materials:

Unlike with many other (industrial) breakfast cereal manufacturing processes, extrusion technology enables mixing of multiple grain varieties to create a product with a better nutritional balance. The choice and combination of appropriate raw materials can meet the special nutritional requirements of specific consumer groups. The variety of raw materials available makes it possible to launch healthy products on the market which also appeal to children with their attractive shapes and packaging.

Breakfast cereal production is a multi-stage process:

Preparation of raw materials:

The grains are mixed with a certain volume of water or aqueous substances. Extrusion blends for breakfast cereals generally contain added milk powder, sugar, malt and cocoa powder, which are fed into the extruder using screw dosing units.

Extrusion:

The blend of raw materials is extruded and expanded into small shapes according to the die selected. The desired texture can be set from soft to crispy to meet relevant market requirements. Small 3D shapes can also be produced using the cutting technology developed by Schaaf.

Pre-drying:

In the subsequent pre-drying process, the untreated raw extrudates are dried.



SWEET SNACKS &

BREAKFAST CEREALS

Flavouring:

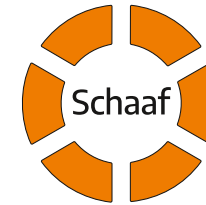
Sugar and flavourings are processed in a two-kettle system to create a water-based slurry, which is then evenly sprayed over the extrudate.

Subsequent drying:

The product is subjected to a second drying stage to remove the water in the slurry. The drum surface, which has a special PTFE film coating, prevents the product, which will have become very sticky due to the melted sugar, from attaching to the walls of the drum.

Cooling:

In another drum, the viscous, ambient air cools and solidifies the melted sugar coating. Any clusters are gently separated in the cooling drum before the finished product is fed into the packaging machine.



SWEET, FILLED

CO-EXTRUDED PRODUCTS



Sweet cream fillings covered by a crispy coating

These products, intended for direct consumption, traditionally have a crispy, pillow-shaped shell (extruded “tubes” with pinched ends) and a creamy filling inside. Either a chocolate, vanilla or other sweet cream filling can be used. Embossing technology can now also be used to create more complex shapes besides pillows, including triangles, hearts, mini sticks and many others.

As well as direct consumption, co-extrudates are also suitable as an additional ingredient in muesli mixtures.

Raw materials:

When choosing recipe ingredients, it is important to ensure that the extruded shell and the cream filling complement one another as a final product. To achieve the very best product quality, the cream filling should have a high level of phase stability and low water activity.

Process:

The extrusion process used to produce the extrudate shell is the same production process used in the manufacture of sweet cereals.

Preparation of raw materials:

Raw materials such as corn, wheat or rice have sugar and possibly co-cocoa powder added, are pre-moisturised and then extruded into a tube shape using a special die-system.

Co-extrusion:

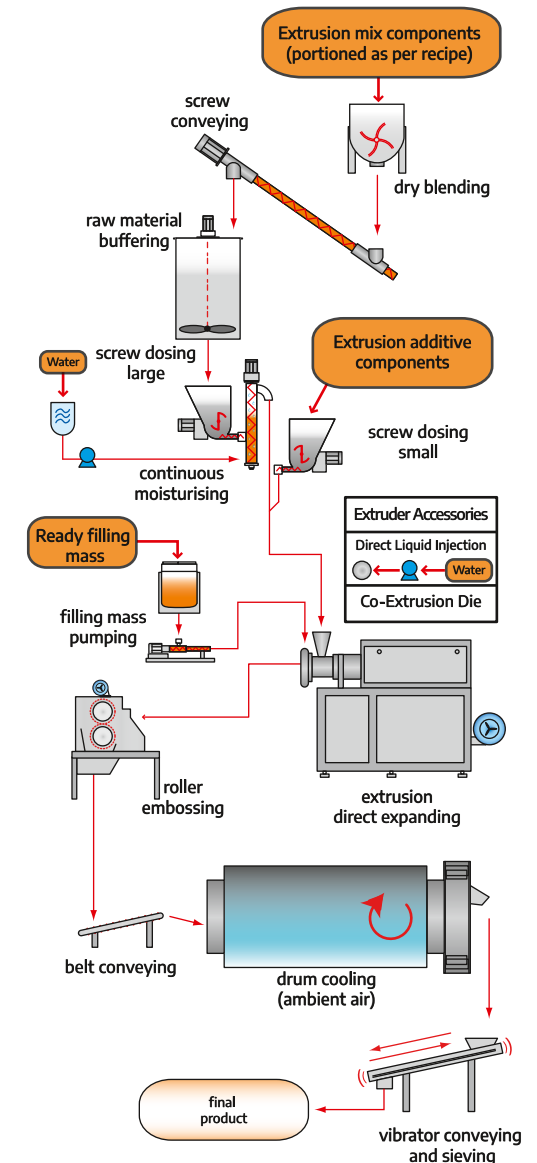
Depending on the properties of the filling used, it may be advisable to temper the filling cream. The co-extrusion die, supplied by the filling pumps, combines the filling and dough at the die outlet and forms a continuous tube filled with cream.

Embossing / shaping:

The filled tube is fed into the embossing machine and shaped into triangles, pillows, sticks, etc., depending on the shape set. The products leave the embossing machine as continuous strands and are transported into a drum on a belt.

Cooling:

Without active drying, the sugary extrudate tubes lose their moisture and therefore their elasticity, and break into the desired final shape in the ventilation drum on the embossing lines provided for this purpose. Depending on the shape, any fines can be sieved out before packing.



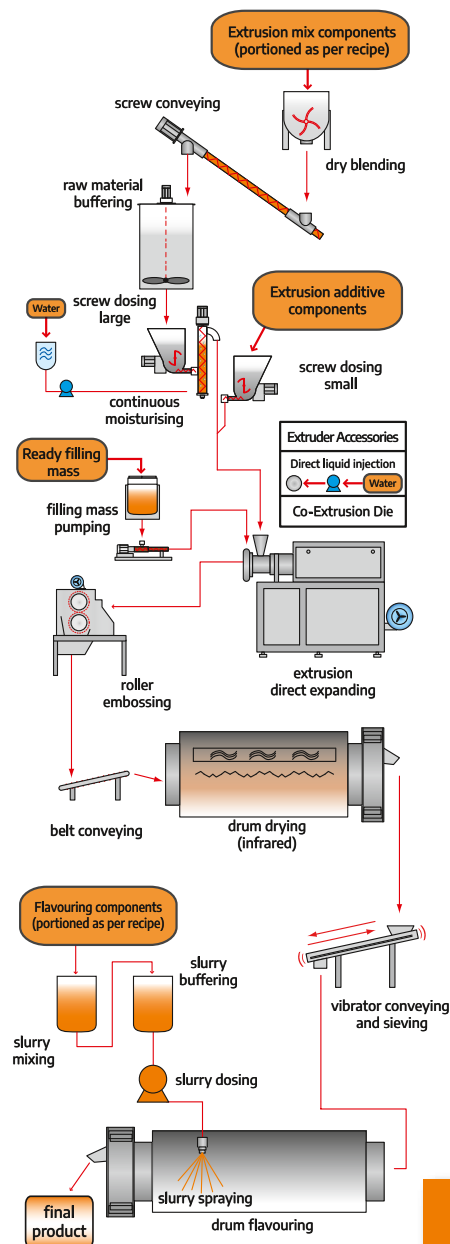


THE NEXT STEP

Savoury snacks with savoury fillings

Co-extruded products with sweet fillings, have long time exclusively been limited to sweet snacks due to the wide availability of sweet fillings, such as chocolate, vanilla or strawberry cream.

As technology has advanced, attractive, crispy extrudate shells have been produced using recipes where there is no need to add sugar or similar ingredients in some cases or even at all.



Peanut butter and cheese cream, to name some examples, are also available in addition to newly developed, fat-based, savoury fillings.

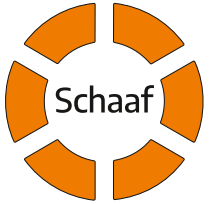
The manufacturing process for savoury, co-extruded products is almost identical to that used for sweet products. However, recipes for savoury co-extrudates contain a comparatively higher water content. This higher extrusion moisture must be removed by gently drying the extrudate shell.

Any embossing residue can be separated from the product flow using a sieve machine and fed to the extruder again in ground form. The product can then be optionally coated with slurry to round off the taste.



SAVOURY, CO-EXTRUDED

PRODUCTS WITH FILLING



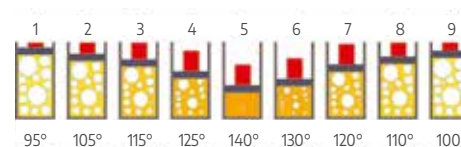
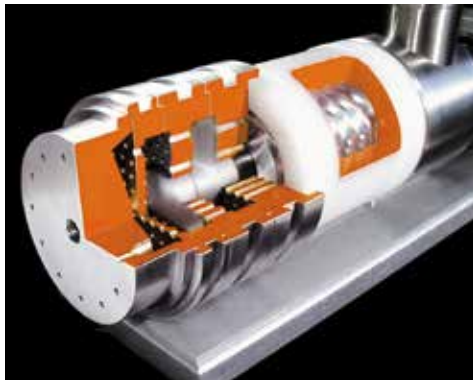
TURBO EXTRUSION

Targeted use of water thermodynamics in extrusion cooking

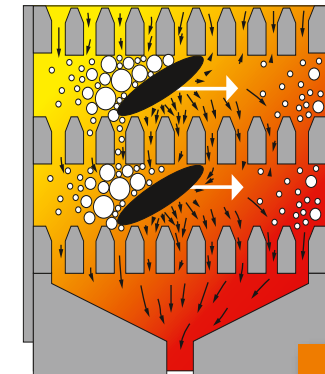
The extrusion process developed by us some years ago works with turbines or rotors. This allows high-viscosity doughs to be transported, mixed and kneaded with turbine blades much more effectively than in conventional single or double-screw extruders. The huge difference in pressure between the front and back of the turbine blades, caused by the dough's high viscosity, is crucial during this process.

While fluid mechanics generally tries to avoid cavitation, this in fact causes significant and beneficial mixing and homogenising effects in food extrusion and ensures optimum heat transfer within the dough.

It has been shown that TURBO extrusion delivers a quality mixing effect that even the far more sophisticated double-screw extruders have been unable to achieve thus far. The classic "screw" is essentially still only a feed element in our processes.



Illustrative example of the relationship temperature and pressure in the turbo process



ADVANTAGES OF

TURBO EXTRUSION:

- Flexibility due to turbine and pressure plate configuring
- Very high throughput with smaller extruder processing section lengths plus TURBO
- More flexibility in choosing raw materials and recipes: fatty, sugary or fibrous materials can be processed
- Antibacterial effect: caused by the interaction between expansion and compression, the germ reduction far exceeds other extrusion processes
- Durability of wear parts and hence low cost of ownership
- Quick, easy and cost-effective cleaning and maintenance of processing sections



The ideal combination of flexibility, functionality and reliability for your production operations

Today, Schaaf extruders are set apart in many areas of food extrusion technology.

Our intensive efforts to constantly create new extrusion opportunities in process technology and to make machines easier and more reliable to handle and operate, and our constant goal of achieving the lowest possible operating costs are the reasons why Schaaf TURBO extruders are hard to compare to other single and double-screw extrusion systems from a technical or technological standpoint.

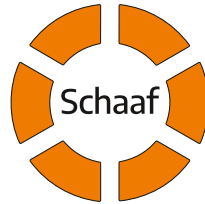
Schaaf extruders are equipped with brushless servo motors, which are characterised by their high efficiency levels and cover a wide output range of 30 to 110 kW, as standard.

Based on more than 40 years of experience in extrusion technology, Schaaf extruders stand out due to the following, fundamental features:

EXTRUDERS

FEATURES

- Robust bearing units with integrated forced oil circulation lubrication and oil pressure monitoring to protect the bearing units
- All extruders are fitted with Schaaf's patented TURBO technology
- Very simple handling of processing parts due to short process lengths
- Excellent linear process control options
- Very short start-up times, since extruders can be started without preheating the processing parts
- Low wear part costs due to specially selected materials that minimise wear and tear
- Low-maintenance belt drives for transferring high torques
- Temperature-controlled water cooling systems for material inlet zones
- Flexible cutting systems for use with the most diverse die systems
- PLC-based operating unit for ergonomic and simple extruder operation



EXTRUDER ACCESSORIES

Accessories for improving extruder operation, efficiency and flexibility

Dosing and mixing raw materials:

Different traditional raw materials can be provided in different ways. Single-product processing lines, which are designed to ensure efficiency, are usually connected to a fully automated, centrally controlled raw material supply system.

If different products with changing raw materials are to be made, manual weighing of the raw materials is often indispensable to maximise flexibility.

The manually or automatically weighed raw materials are fed into the horizontal batch mixer and vigorously mixed.

The batch mixer offers the following features:

- Optimised design for even raw material mixing
- Made entirely of stainless steel to guarantee hygienic production operations
- Automated dosing of water for the pre-moisturising of dry raw materials available as an option

The mixed raw materials are transported to a buffer silo and are stored temporarily to provide the downstream dosing units with raw material while a new batch can be prepared in the batch mixer.

Dry materials can either be moisturised with water or aqueous substances. As well as adding water directly into the batch mixer, for some products it can be beneficial, or even necessary, to add the water directly before the actual extrusion process takes place in order to achieve certain product properties or to even enable the wetting of special recipes in the first place.

CONTINUOUS

MOISTURISER

Schaaf provides a range of useful units to control the extrusion moisture. The continuous moisturiser facilitates (in-process) control of extrusion moisture with short reaction times. As such, variations in raw material moisture levels, for example, can be easily compensated for without interrupting the production operations. With a direct connection to the main dosing unit, the raw materials are wetted with a pre-set volume of water, mixed vigorously and then transported directly into the extruder. The special stainless steel design allows for easy dismantling and cleaning, enabling daily use with the extruder.



DIRECT LIQUID INJECTION

Direct liquid injection (DLI) is a further development of the TURBO technology patented by Schaaf for new, attractive, directly extruded products with appealing colours and textures. The process enables a certain volume of water or other low-viscosity liquids to be injected straight into the processing section. Even very sticky substances or liquid colours can thus be incorporated into the process without contaminating the raw material preparation system.

When combined with water added to the batch mixer, the result is a flexible, economical water dosing system that enables the extrusion moisture to be controlled with ease during the production process.



MULTI-COLOURED PRODUCTS

Unlike for solid-coloured products, which are made by adding the colour to the batch mixer or through a dosing unit, the dough flowing into the extruder processing section is divided into two separate chambers for the production of multi-coloured extrudates. A coloured liquid is injected into one chamber using a high-pressure pump. The coloured and uncoloured dough are only combined again shortly before they exit the die to prevent them from mixing inside the extruder.

Partial mixing can be achieved if desired by combining the dough at an earlier stage on the inside of the die. This creates a “marbled” extrudate.



THINWALL CHIPS

Making thinwall and crunchy products by direct expansion process

Peanut curls, cheese puffs, corn sticks and onion rings are well-established and well-known snacks that are complemented by their attractive three-dimensional shapes, such as crocodiles, dinosaurs, dolphins and so on. As with many other foods, they are now produced using extrusion cooking.

These finished products, which measure between 3 and 10 mm thick and which are traditionally produced with extrusion cooking methods, are very common, but tend to be puffed, soft and light.

When it comes to thin products like wafers, cornflakes, potato crisps and tortilla chips, however, consumers prefer a typical crunchy texture.

A process developed by Schaaf now also allows for the manufacture of crunchy, crispy products by purposefully stretching the extrudate shell.

The resulting products can be fed into a dryer or a deep fat fryer for further processing and, with the direct extrusion process, create textures that have never been combined before.

Ask us about our attractive new products.



MULTI-TEXTURED PRODUCTS

The option of injecting liquid into part of the dough offers another advantage:

Injected liquids change the consistency of dough. As doughs with different moisture or fat contents achieve different degrees of expansion, multi-textured products – i.e. products with crunchier / softer or rough-pored / fine-pored parts – can be made by purposefully combining or mixing batches of dough within the extruder. Extrudates that are brand-new products for direct extrusion.



INFRARED DRYERS

Thermal post-treatment of extrudates, compact and highly efficient

To dry products, Schaaf uses specially developed short and medium-wave infrared radiators which are extremely efficient.

Unlike conventional hot air drying process, where the energy is mainly transferred by the air, the infrared drying process heats the extrudate directly.

Continuous adjustable radiation elements allow the products to be dried gently until the desired degree of roasting has been reached.

The rotating drum body is cased completely to minimise energy losses and to comply with the most recent accident prevention regulations.

The special drum profile guarantees gentle product rolling and thus ensures a consistent drying result.

Available drum diameters:

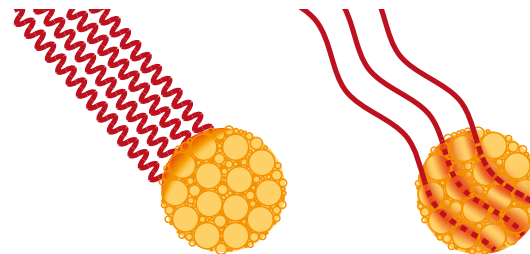
800 mm / 1200 mm / 1600 mm

Installed electrical heating capacity:

42 kW / 84 kW / 126 kW

Drum length:

ca. 4500 mm



Short-wave radiation

Long-wave radiation





SLURRY PREPARATION SYSTEMS

Challenging and attractive shapes require homogeneous coatings applied evenly to the products

Schaaf offers preparation systems with capacities of 100 to 1000 litres for producing savoury suspensions or sweet, water-based slurries.

The kettle systems, consisting of two sturdy stainless steel kettles, are designed double jacketed and can be indirectly tempered with even heat transfer using electrical heating with a special thermal liquid.

The slurry preparation systems are made entirely of stainless steel, which makes them easy to clean and means they comply with current hygiene requirements.

Flexible piping, which is easy to clean with hot water, connects the application kettle to the dosing pump and the spraying system.

One or more two-substance nozzles fitted on adjustable brackets distribute the slurry evenly across the dried, raw extrudate.

The special profile of the application drum allows for ideal product rolling for an even coating, all the while maintaining the lowest possible product surface abrasion.

A lack of covered corners means that easy cleaning is enough to keep the drum surface free from bacteria.





BREAD CHIPS

Perfect presentation of a contemporary, trendy food

Raw materials / preparing raw materials:

The selection of suitable recipes is crucial for the production of crispy bread chips with an even texture if high-viscosity doughs that enable significant thickness expansion are to be created. Wheat flour with a high gluten content is used for this in most cases, which makes the finished product even more similar to bread. Wholemeal recipes can be used as a variation.

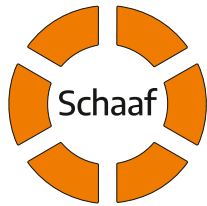
Extrusion:

Unlike other shapes, bread chips are not cut directly at the die. After a short cooling down and solidification phase, the extruded strand is cut into slices 6 to 9 mm thick in the bread chips cutting machine. When the solidified material is cut, open pores form, giving the extrudates a new, attractive appearance and texture associated with freshly cut baguette bread.

Drying / flavouring:

If desired, the surface of the product strand can be sprayed with a newly developed colour spraying system to make the product look even more attractive. The products are transported pneumatically into a dryer, where they are dried to a moisture content of approx. 2 to 3%. The pleasantly flavoured bread chips are consumed as a snack or served as a side dish along with a dip.





Schaaf Technologie GmbH

Otto-Hahn-Straße 36

65520 Bad Camberg

Germany

Phone: ++49 (0) 64 34 / 91 72-0

Fax: ++49 (0) 64 34 / 91 72-72

E-mail: info@schaafgmbh.com

Internet: www.foodextrusion.com

Schaaf Technologie GmbH Asian Operations

A-1/68 (LGF), SAFDARJUNG ENCLAVE

NEW DELHI - 110 029 / INDIA

Phone: +91 (11) 41006700

Fax: +91 (11) 41652750

E-mail: schaafasia@schaafasia.com

