



- amixon® whitepaper -

Instant Food

amixon® mixers for Instant Food



The ability to protect food from going off is a high cultural feat. Even more than 10,000 years ago, storing food by protecting meat or excess crops from spoiling was essential for survival. What we now call packaging was also a top priority back then. Pits in the ground, leaves and animal skins were places of storage. Using clay jugs and woven baskets, our ancestors were able to meet further requirements: they were able to do trade with food, they were able to take stocks of food with them on journeys, during military conflicts and in times of crisis. They thus developed many ways of preserving and transporting food. The maxim always applied that food should not only taste good, but also be conveniently available.

These days, instant foods are offered as hot or cold meals. Instant food is all the better quality the more nutritional it is and the more natural it tastes. The preparation process must be simple, preferably with a "success guarantee". What is more, an instant meal is all the more interesting the longer it can be stored without a loss of quality – preferably regardless of the ambient temperatures in winter and in summer and in the widest range of climate zones. Instant food is a long-term form of nutrition! The crux here is the long-term stability / minimum storage life (best-before date) of the instant food.

This requires effective preservation methods. Dry food mixtures can have outstanding instant properties and they can taste extraordinarily good. With regard to long life, particularly high importance is attached to the dry mixing process. It must be gentle to the ingredients and take place preferably without any oxygen, and, if possible, it should happen immediately before the filling and sealing process.

If you take into account that the taste of non-perishable foods changes, then you can cure meat and fish in salt or smoke it, ferment white cabbage to make sauerkraut, preserve fruit in alcohol or wine vinegar, or cook fruit preparations to make jam and marmalade. Chemical preservatives such as sorbic acid, sodium sorbate, potassium sorbate, calcium sorbate, benzoic acid, sodium benzoate, potassium benzoate and calcium benzoate have little influence on the taste but require declaration. Their effect is specific in different ways. Some preservatives kill fungal spores, others deactivate microbes or enzymes. Their use requires a particularly homogeneous, even distribution. For nutritional physiology reasons, their use should be kept to a minimum. Some instant food manufacturers advertise the use of preservatives that are identical to nature.

Physical preservation methods first and foremost extend to the removal or deactivation of the water. Vacuum freeze drying is the highest quality form of preservation here in terms of retaining taste and structure - but unfortunately also the most expensive. Unlike simple hot-air drying (dried fruit), where the capillaries of the fruit shrink and stick together, with vacuum freeze drying, the taste, colour and also form of the fruit are preserved, even after subsequent soaking. Freeze drying can also be excellently used for meat preparations. After adding hot water, the spicy flavours from the Maillard reactions soon come back.



The most cost-effective way of removing water takes place in the drum contact dryer (potato flakes, starch, cereals, cheeses...). But the more elaborate spray drying method is also widespread (baby food, dietary foods, plant extracts). Both drying methods require that the food is liquefied beforehand into a pumpable or even sprayable consistency. Spray-dried foods are usually easy to agglomerate and then have outstanding instant properties. The particles produced are easily wettable with water, dispersible or soluble.

For types of food that come in pieces, such as fruit, fish and meat, hot steam sterilisation at 180°C in an autoclave at a pressure of at least 12 bar is suitable. The deactivation of enzymes and microorganism caused by this leaves the water in the food. This applies equally to the traditional method of bottling for food in jars, which has been practised in private households for generations to this day. A defined cooking period displaces the atmospheric oxygen and deactivates microorganisms. The vacuum in the top space of the container shows whether the goods have remained intact. To prevent glass breakage of UV light, the industry likes to use cost-effective tin cans, particular for goods from overseas.

Vacuum packaging or inert gas packaging also makes dry foods last longer (seeds and nuts). In the absence of atmospheric oxygen, the metabolism of microorganisms is largely blocked. Deep freezing at temperatures below minus 18°C is widespread, which also does little harm to taste and flavour. Here too, all the water remains in the food. Colour, shape and texture are better preserved the faster freezing takes place. Particularly tasty meal combinations are possible when the side dishes, vegetables and the meat are partly cooked separately and shock frozen and sealed in trays after being prepared. This method of preserving is comparatively expensive, however, and probably less sustainable with a view to environmental protection. The deep-freeze chain through to being consumed must not be interrupted.

Another physical preservation method should be mentioned at this point for the sake of completeness, namely exposing the food to ionising radiation. In Germany, unlike abroad, this irradiation process is not so popular and only allowed for dried, aromatic herbs and spices and must be marked. According to the World Health Organisation (WHO) as well as the EFSA, the irradiation of food with gamma, UV and X-rays for the purpose of sterilisation is harmless to health.





Erbswurst (pease-flour sausage) was one of the oldest industrially produced instant meals. It is not a sausage in the proper sense, but instead portion tablets that are packed in a sausage-shaped paper roll coated with aluminium. These can be quickly made into a creamy pea soup by mashing the portion pieces, dissolving them in cold water and cooking for a few minutes. Erbswurst was developed in 1867 by the cook and canner, Johann Heinrich Grüneberg from Berlin. He soon sold his invention for 35,000 Vereinstaler to the Prussian army, which distributed it from 1870 onwards in the Franco-Prussian War – firstly as an “iron ration” – to its soldiers. Previous to that were trials by the Prussian War Ministry, where soldiers were fed solely on erbswurst and army bread for six weeks while doing their normal duties.

Image source : <https://commons.wikimedia.org/wiki/File:Erbswurst-1.jpg>
Source : <https://de.wikipedia.org/wiki/Erbswurst>

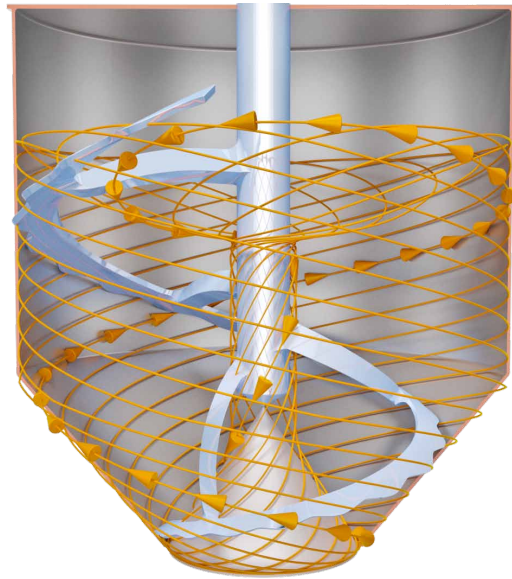
Recent history

At the start of the first industrial revolution, in 1852 the German chemist, Justus von Liebig, presented a dried meat extract, which seemed particularly advisable to him for supplying broad sectors of the population with food. His efforts to produce meat extracts on an industrial scale failed, however, due to cost reasons.

At the start of the 20th century, the Maggi cube appeared on the market as a plant-based instant food. Due to the cheaper raw materials, the Maggi cube prevailed against the dried meat extract. To this day, the stock cube is a blockbuster and the epitome of ready-to-eat instant foods.

Times of wars and crises often act as catalysts for ground-breaking innovations. When the United States government decided to enter the world war in 1941, it evaluated Europe as a potential hunger region. In order to supply the dispatched soldiers as best as possible nonetheless, high-calorie, non-perishable instant foods were developed. The rations consisted of three differently composed standard meals with a minimised proportion of water. These included stock cubes, dried fruits, chocolate, tinned meat, coffee and processed cheese. After adding hot water, the soldiers had nutritional meals with which their calorie and mineral intake was able to be covered over longer periods. In 1948, the Soviet military administration in Germany blocked the traffic of people and goods from and to West Berlin. The imminent lack of food in West Berlin would have been life-threatening if the allies had not set up an airlift. The limited air freight capacities had to be reserved for the most essential items, and only food without water content was supposed to be transported. As a result, industrial production facilities for dried foods were set up in the south of the United Kingdom with the help of the USA.

In Japan too, there were efforts to manufacture instant food after the end of the war. Momofuku Andō developed an instant noodle dish by cooking noodles and drying them as a porous block. Packaged in a cup with seasoning oil and flavours, all that was needed was to add hot water. He thus created the nucleus of what is now Nissin Foods, a Japanese manufacturer of countless instant meals. In 2020 one of their instant foods called space ramen was selected for manned space travel.



Functional Food

Back in those days, basic provisions with nutritional energy was a priority; although the taste was important, it was secondary. Nobody would buy the substitute food developed in an emergency back then these days because the food industry has improved the taste of instant food tremendously. Today we have an overwhelming array of instant meals based on dry ingredients. Instant specialities from a range of continents are even able to convince culinarily spoiled consumers.

The term functional food was coined in Japan in 1985. By this it is meant that food increases well-being, is particularly beneficial to health and even helps to prevent illnesses. Although promotional promises to cure are not currently allowed in the EU, the term functional food is used in B2C circles. Supplementary additives are, for example, vitamins used as antioxidants, fibre, mineral nutrients, probiotics, prebiotics, unsaturated fatty acids, herb extracts from ginseng, aloe vera, ginkgo, isomaltose, ...

Many providers have turned “functional food” into their business model and, with their instant meals, take into dietary aspects such as: natural metabolic stimulation, beauty from the inside, weight reduction, basic nutrition against hyperacidity, cellular purification and detoxification, vitalising cell regeneration, wholesome food without sugar, inner balance and restful sleep, increased physical performance, stress resistance or fat burning.

“We are what we eat”. The philosopher and anthropologist, Ludwig Feuerbach, said that back in the 1830s.

Benefits for private consumers

In nearly every household today there are packet soups, powdered sauces, sauce dressings, salad dressings, cold sweet soup and pudding powders, baking mixtures, potato flakes for purees, instant noodles or rice. They have a long shelf life, can be stored in a space-saving manner without cooling, are very tasty and quick to prepare.

The life plans of many people in today’s urban, advanced civilisations differ significantly from those of our forefathers. Life in families with lots of children required fixed meal times back then. Food preparation was in the light of shortages, it was laborious, strenuous and often varied little. It was influenced by what was regionally and seasonally available. With the start of the first industrial revolution about 150 years ago, a new age of nutrition began, characterised by the division of labour and globalisation. More and more people became disengaged from farming and agriculture to work in factories. Newly emerging food factories specialised in the processing of all possible kinds of food crops.

It is interesting that we are seeing a countermovement in some areas today. Some start-ups are substituting highly processed foods with largely natural ones. They are creating instant food at a technologically high level by applying long-forgotten home recipes used by their ancestors.

The number of single households, particularly in cities, is rising and indeed across all age ranges. Quickly and easily preparing a small hot meal, at no matter what time, whether at home, at the office or on the go, with friends or alone is perceived as normal. This convenience is immediately derived from the benefits of instant foods.

The general rule is that, when the water activity of a dry ready meal is less than 4 %, this ensures sufficient microbiological stability. The instant food, allowing for clean production and adequate packaging, remains naturally durable for a long time even without cooling; free of toxic moulds such as mycotoxins and aflatoxins. Liquefied, highly concentrated foods can only exhibit similarly good storage stability with difficulty. Instant food is also a convenient product. Every ingredient is already contained in the sachet in the right quantity. This also ensures that there are no leftovers. When it comes to preparing it, no cooking skills are required. Because instant foods offer a “success guarantee”. All that is needed is to add the right amount of liquid and to keep to the timings in order to produce a tasty meal. The portioning of water and powder is done highly accurately and hygienically in vending machines. These mostly provide vending machine soups with a wide variety of flavours.

Advantages and development of system catering

Much of what consumers appreciate and enjoy has also penetrated system catering. Commercial kitchens make use of all the benefits that make instant food attractive, but they do it in a clever way, because the instant specialities are reserved by the industry for professional cooks. What is more, they are cleverly combined with fresh or deep-frozen fruits. Even professional tasters confirm exquisite quality standards. Here too, the user benefits of instant goods dominate:

Highly concentrated catering products reduce preparation times as well as personnel costs in the kitchen. Because powdered instant food components take up little storage space and are easily manageable, they give the cook a wide variety with an extremely short reaction time. The “success guarantee” largely applies here too. Instant food is purchased and procured to keep in stock, disconnected from day-to-day events.

Commercial kitchen of the Charité around 1900

Image Source: https://upload.wikimedia.org/wikipedia/commons/6/66/Charit%C3%A9%2C_Dampfkochk%C3%BCche.jpg

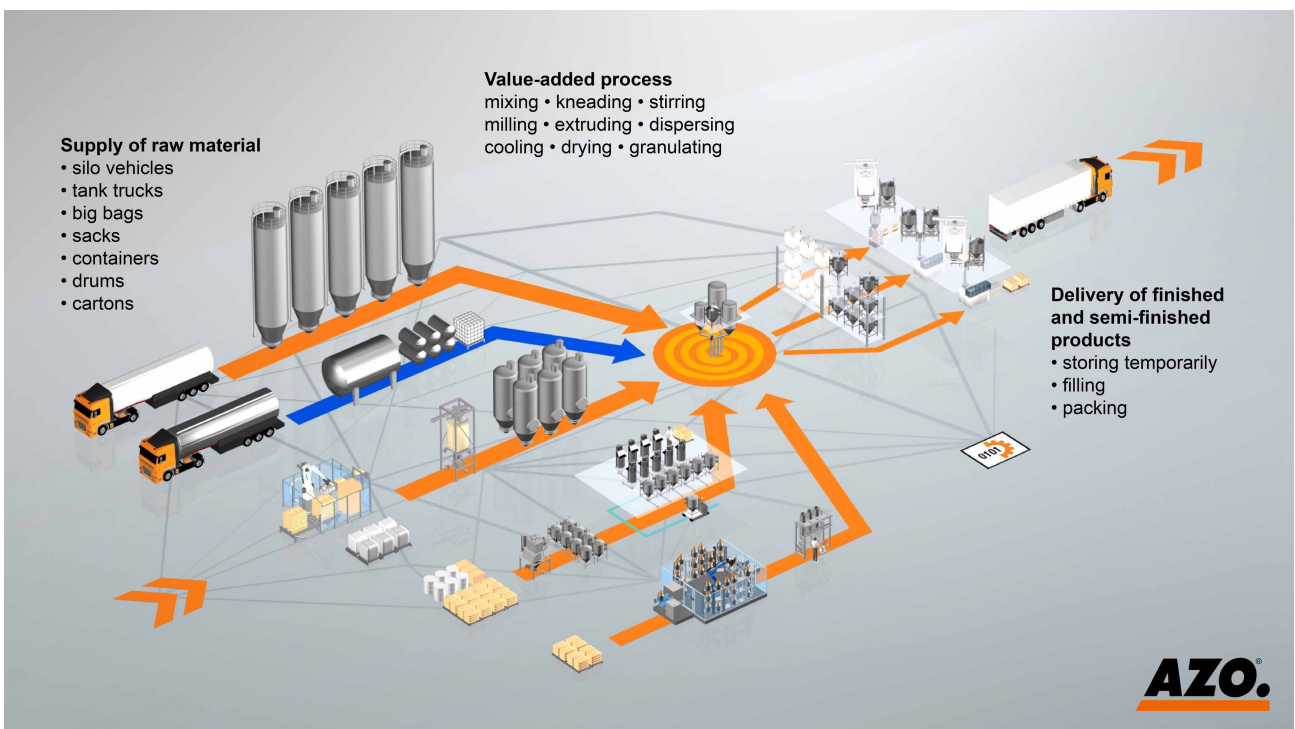


Fabrication

In order to meet the various requirements of end consumers and the catering sector, “basic instant” are made from a wide variety of dried, moist and liquid basic materials in industrial-style powder mixing plants. The number of individual components used is immense and reflects the vast array of spices, flavours, stabilisers, enzymes as well as additives, liquid extracts, oils and essences.

The final powder mixing process is critical for determining the quality of the instant product; besides taste, taste stability, storage stability and solubility, this also includes texture, viscosity, bioavailability, colouring and mouthfeel.

Modern food factories are automated to a high degree, meaning that nearly all process steps are done by machine – the raw material intake (dry ingredients as well as liquids), sampling and quality assessment, conveying and warehousing, dosing extraction, batching via the mixer, mixing and filling. As well as for the mixer, it also applies to all other process steps that the structure of the powder should remain intact. Any energy input must be kept to the necessary minimum. Compression and shearing stress is to be avoided.



Preparation of instant foods from the raw materials into the finished product
Image Source: AZO GmbH, Osterburken

amixon® mixers fulfil the highest quality criteria

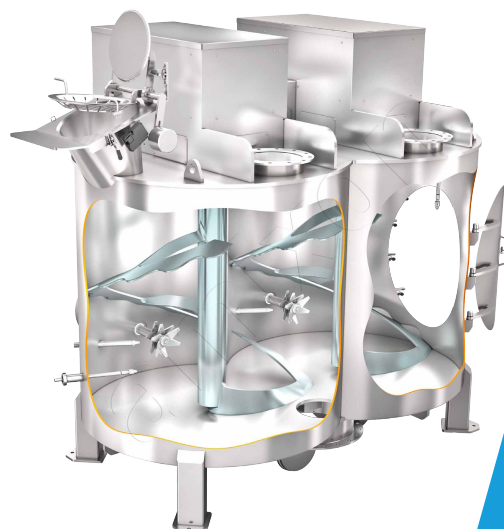
Even when the food powder exhibits the mentioned attributes, such as the taste or colour, it cannot be definitely called instant food yet. The powder must react as expected when the liquid is added. It must demonstrate a typical instant solubility. The air in the powder must escape from the bulk material to the extent that the powder penetrates and lowers the liquid level. Sinking behaviour, solubility and dispersibility must meet the consumer's expectations. The consumer also expects good storage stability and pourability when they empty the packaging.

amixon® precision mixers have been precisely developed for the preparation of instant food. Three decades of experience in the final mixing of instant food have led to specific characteristics.

The properties and methods of the amixon® mixers:

1. Ideal mixing qualities; regardless of whether the mixing material is dry, moist or suspended. No matter whether the components are powdery, in granulate form, crystalline, lumpy, fatty or wet.
2. minimally short mixing time, even with liquid admixtures
3. low energy input and protection of the particles; for example, freeze-dried dill tips, cauliflower, broccoli, onion rings, pieces of noodle, etc.
4. variable filling levels have no influence on the mixing quality
5. high-grade residue-free emptying; without segregation or particle damage
6. ideally simple cleaning: microbacterially controllable and safe with regard to allergen / non-allergen and halal or kosher hygiene requirements:
 - o dry
 - o wet
 - o manual or automatic
7. Mixing results from the trial scale can be reliably transferred to the industrial scale with a batch size of more than 5000 litres: The design of an industrial mixer for instant food is not trivial. Even though flow processes can be easily described and simulated, it is not possible so far to calculate the crushing of the particles if an aggregate material ten times the size with a heterogeneous particle structure flows through a congruent mixing tool with no dead space. Only the experience and the mixing trial in a test centre operated by the manufacturer will help here.

amixon® mixer HM 2000





amixon® mixer AM 1500



Semi-solid materials are also prepared in the amixon® mixer. Unlike in kneaders, cutters or extruders, a higher mixing quality is generated with a low energy input. Such semi-solid masses are not packed in bags, sachets or cans like powder, but instead shaped, wrapped or rolled into instant food cubes.

Since 1983 amixon®, based in Paderborn, has been a manufacturer of unique precision mixers that have been designed and produced according to its own patents. amixon® mixers work worldwide in all areas of food production and particularly in the manufacture of instant food. The smallest machine batch volumes for instant food are 100 litres, whilst the largest instant food mixers feature a batch size of 5000 litres.

At this point, the original words of the technical director, Ludger Hilleke, should be quoted:

“Although amixon GmbH only produces in Paderborn, Germany, we have application test centres available for our customers in the USA, China, Japan, Korea and Thailand. There we are able to demonstrate the quality criteria to our customers and fulfil them with the original products. We cordially invite you schedule trials together with us. amixon® guarantees you outstanding mixing results and a particularly high level of information in advance!”

Details of the design of the amixon® mixer for instant food

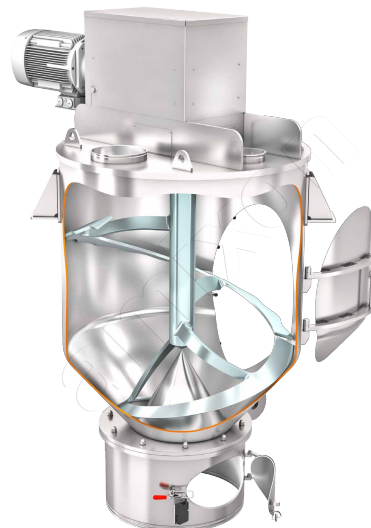
Batch size? intermediate sizes are also possible!					
[litres]					
up to 400	up to 1000	up to 2000	up to 3000	up to 4000	up to 5000

Amount of semi-solid and liquid admixtures to the solid material?					
[percentage of the total mass]					
up to 2	up to 4	up to 6	up to 10	more than 10	

Multi-step procedure required?					
[Number of individual mixing steps after each component is added]					
2	3	4	more than 4		

Discharge after the mixing process?					
completely into an outlet bin	portioned into different outlet bins	into container or big bag	directly into a high-performance packaging machine	into several high-performance packaging machines at the same time	the mixer should deliver in doses into sacks or bags

amixon® KoneSlid® mixer KS 500





amixon GmbH

Halberstaedter Strasse 55

33106 Paderborn

Germany

Telefon: +49-5251-688888-0

Telefax: +49-5251-688888-999

www.amixon.com

sales@amixon.com