

From bean to burger

People are eating less meat for environmental, ethical, and health reasons. They want nutritious alternatives that taste great. Today's plant-based meat substitutes offer both. When it comes to the technology and know-how behind this growing market, Bühler has the edge.

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Raw materials

Soybeans

Some 6% of the world's agricultural land is cultivated with soy. This legume is considered to be the most important oilseed and is widely used for the production of feed. Because of its high protein content, it has also been used in Asia for hundreds of years as a vegetable protein source, for example as tofu.

Pulses

Beans, peas, chickpeas, lentils, vetches, and lupins belong to the legume family and can be dried and used as healthy and nutritious foods. Hundreds of varieties are grown in 173 countries around the world. Pulses are a low-fat source of proteins that also contain fiber, and important micronutrients.

Oilseeds

Oilseeds are energy-dense foods, due to their high oil content. They are rich in protein, fiber, vitamins, and minerals. They make a naturally significant contribution to human dietary protein intake. Sunflower seed and rapeseed expeller cakes are nutritious and healthy ingredients for meat substitutes.

Tomorrow's protein sources

The cultivation of single-cell organisms with a high protein content is a field widely researched at the moment. Many universities and research institutes have developed initial projects for growing microalgae, yeast, fungi, or bacteria in tanks. When extracted as powder they can be a valuable resource of protein for meat substitutes.

Process

The raw materials are processed into protein isolates (wet process) or protein concentrates (dry process). Both can then be used as the main protein source for the production of alternative meat products.

Starch-rich fraction

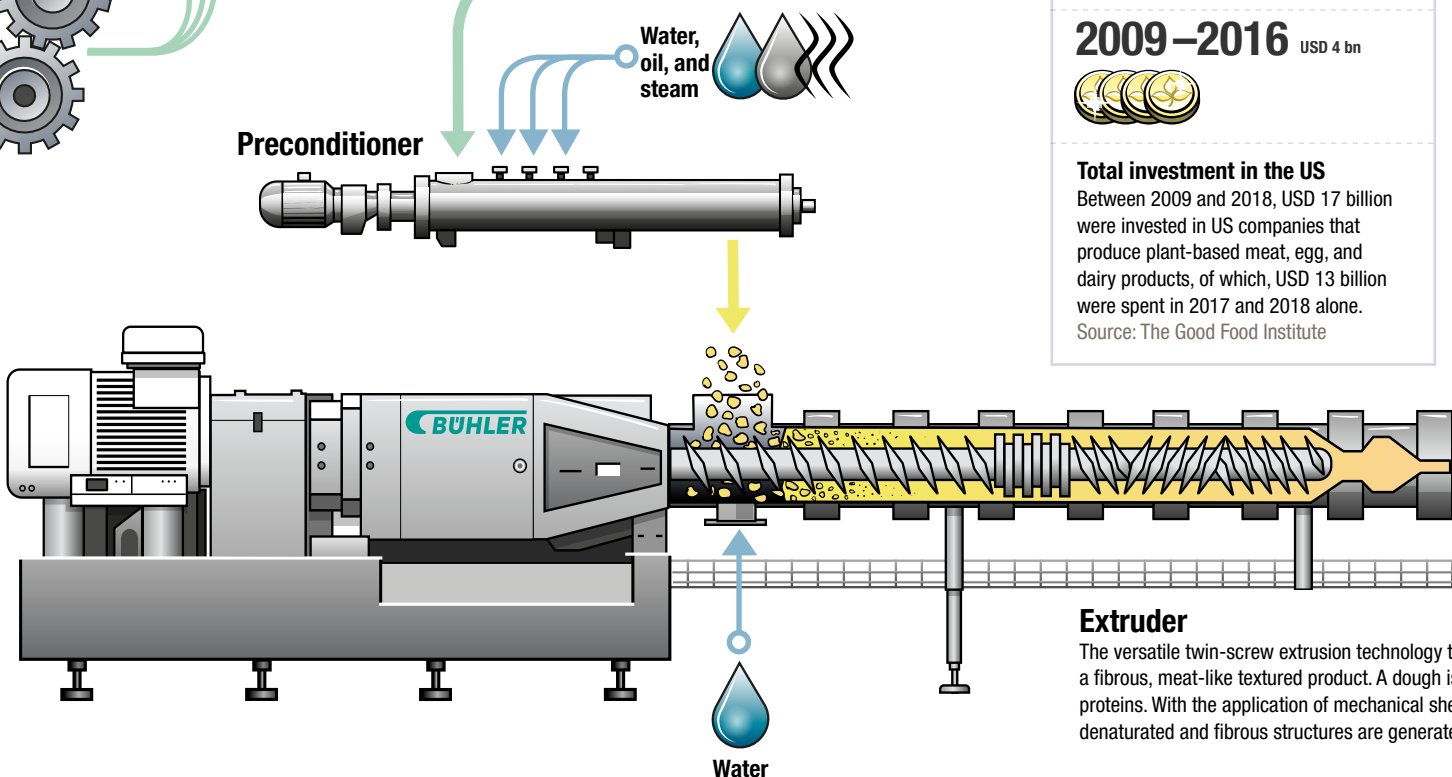
The side streams of the protein extraction process contain a high amount of starch which can still be used as healthy ingredient for other food and feed applications. In particular, they are ideally suited to the production of noodles, snacks, or chicken feed.

Protein concentrate or isolate and oilseeds

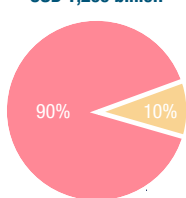
Protein concentrates are derived from the mechanical separation of flour, using the density difference from the starch and protein fraction. Protein isolates are further separated with a wet process, where the proteins are dissolved. These products are typically higher in protein content, with less taste from the origin raw material. Oilseeds expeller cake can be upcycled after the oil pressing and used as a high-protein ingredient.

Fiber-rich fraction and flours

Fibers are a healthy ingredient that is naturally available in the raw material. With added fiber, the product texture becomes stronger, and the protein network is more stably interlinked. There is a multitude of fibers available, like pea, citrus, or apple fibers. Flours can also be used as a minor or major ingredient to adjust the product behavior.



USD 1,200 billion

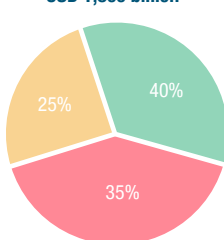


2025

Global meat market forecast

A number of meat alternatives are evolving, among them extrusion, cultured meat, and fermentation-based technologies, each with the potential to disrupt the global meat industry. Source: ATKearney

USD 1,800 billion



2040

Cultured meat

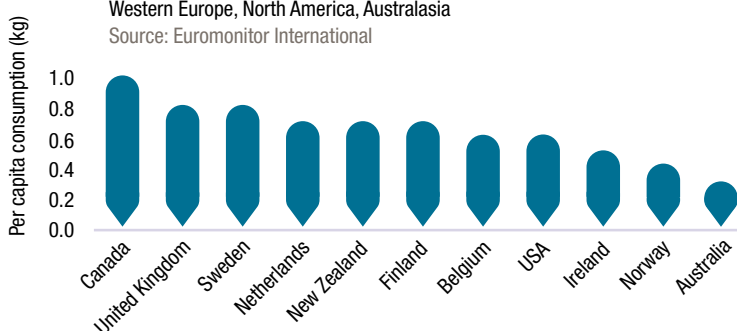
Novel vegan meat replacement

Conventional meat

Total consumption of meat substitutes 2019

Western Europe, North America, Australasia

Source: Euromonitor International



Fortification and flavoring

Ideally, meat substitutes contain all of the positive ingredients of meat, without too much fat and cholesterol. Important vitamins, such as B12, and minerals, such as iron, fortify the textured product. In some cases, natural flavors are added as well to imitate the taste of real meat in the product.

2017–2018

USD 13 bn



2009–2016

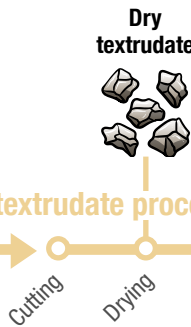
USD 4 bn



Total investment in the US

Between 2009 and 2018, USD 17 billion were invested in US companies that produce plant-based meat, egg, and dairy products, of which, USD 13 billion were spent in 2017 and 2018 alone. Source: The Good Food Institute

Dry texturdate process



Minced meat substitute

Plant-based burger

Wet texturdate process



Plant-based pulled chicken and nuggets

Milk analogues process



Oat milk or other milk substitutes

Yogurt bacteria

Fermentation

Plant-based yogurt