

Comprehensive Analysis of the Automatic Biscuit Production Line: Raw Material Processes, and Technological Innovations

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Introduction

In the global snack food market, biscuits have always held an unshakable position. According to Statista data, the global biscuit market size exceeded \$125 billion in 2021, maintaining a stable compound annual growth rate of over 4.5%. China, as the world's second-largest consumer market, produces more than 8 million tons of biscuits annually, making it one of the core engines driving the food industry's growth.

However, under the impact of consumption upgrade and the health eating trend, the traditional biscuit industry is facing dual challenges: on one hand, consumers' requirements for product quality are becoming increasingly stringent, shifting from 'filling snacks' to 'low sugar, low fat,' and 'gluten-free' functional needs; on the other hand, rising labor costs and energy pressures are forcing companies to seek more efficient and smarter production solutions.

In this context, the value of new type automatic biscuit machine production line for companies is becoming increasingly prominent. Through scientific innovation in raw material formulation, precise control of production processes, and the large-scale application of fully automatic equipment, biscuit manufacturing has not only achieved a leap from 'experience-driven' to 'data-driven,' but also opened up new possibilities in texture, flavor, and health attributes. This article will delve into the core links of the biscuit production chain: from the differentiated application of raw materials such as wheat flour and tapioca starch, to the underlying logic of crumbly/elastic biscuit processes, and finally, how fully automatic production lines reshape industry standards through technological innovation, providing practitioners with a reference guide that combines theoretical depth and practical value.



Core ingredient analysis:wheat flour vs. tapioca starch

The flavor and texture of biscuits are determined by more than 60% of the ingredients. Among these, wheat flour and tapioca starch, as the two main base ingredients, significantly influence the product's positioning and process design due to their different chemical properties.

Wheat flour: The backbone builder of traditional biscuits

Chemical properties:

Wheat flour is made from grinding the wheat endosperm and consists mainly of starch (75%) and protein (8-15%). Its core value lies in gluten protein (Gluten), which forms a three-dimensional network when water is absorbed by gliadin and glutenin, giving dough elasticity and extensibility. Based on protein content, wheat flour can be classified into:

- High-gluten flour (protein $\geq$ 12%): Suitable for hard biscuits, requiring strong kneading.
- Low-gluten flour (protein $\leq$ 9%): Used for soft biscuits, avoiding overdevelopment of gluten.

Craftsmanship

During baking, gluten networks interact with starch:

- Shape support: Gluten denatures and solidifies between 60-80°C, forming the biscuit structure;
- Moisture control: Starch gelatinization absorbs free water, affecting crispness and shelf life;
- Maillard reaction: Proteins and reducing sugars generate caramelized flavor compounds at temperatures above 140°C.

Industry applications

Traditional hardbiscuits, such as soda crackers, rely on the extensibility of high-gluten flour, forming dense layers through rolling and folding. In contrast, softbiscuits use low-gluten flour to reduce elasticity and combine it with high fat content (20-30%) to block gluten connections, achieving a melt-in-your-mouth crispiness.

2. Cassava starch: an innovative carrier for the gluten-free revolution

Chemical properties:

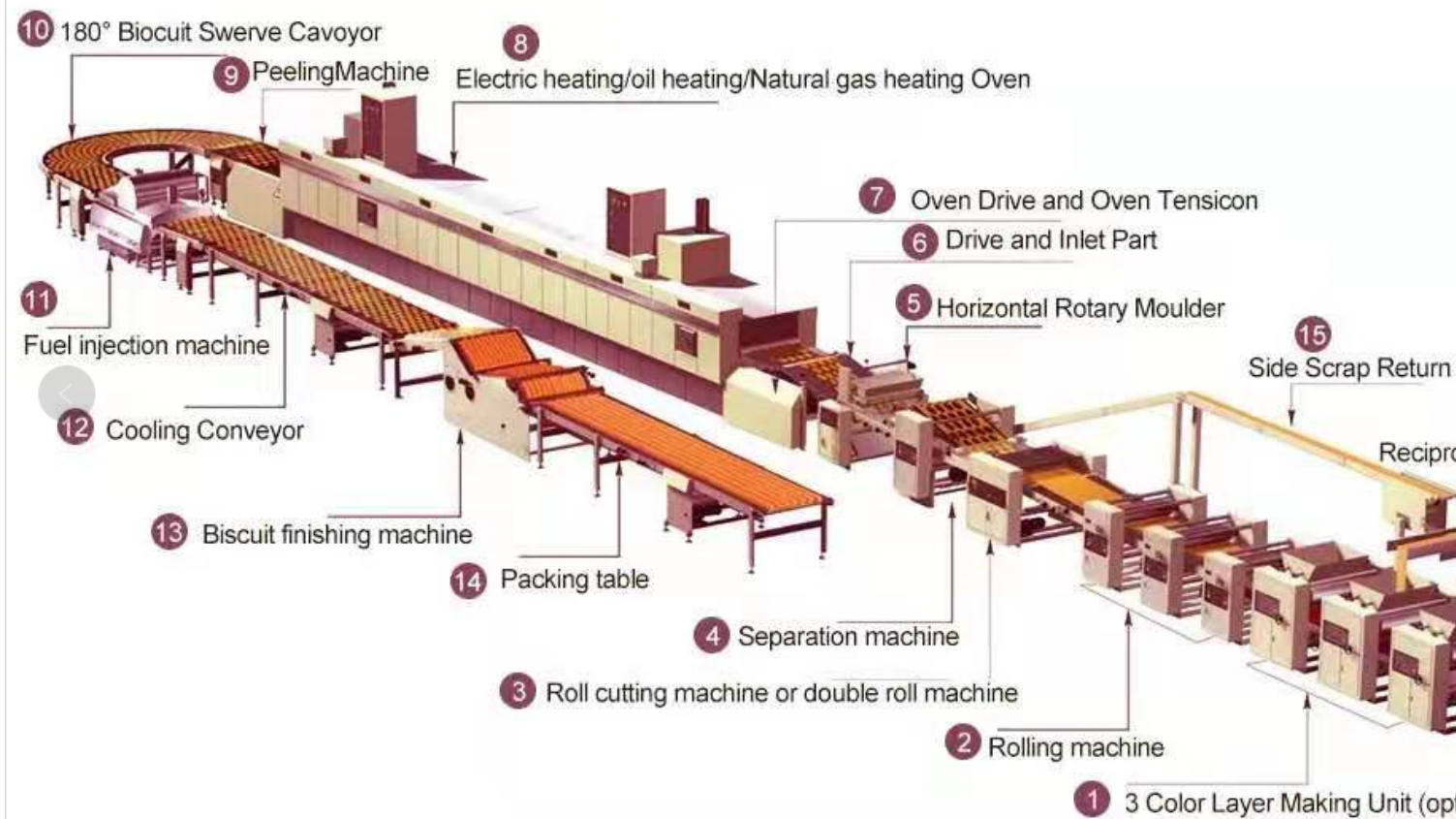
Cassava starch is extracted from cassava roots and contains up to 83-88% starch, with almost no protein or fat. It has low levels of amylose (17-20%) and a gelatinization temperature (52-64°C) that is significantly lower than wheat flour (58-68°C), resulting in a more transparent and hard gel structure when cooled.

Advantages of the process:

- Increased crispiness: The small granules of cassava starch expand rapidly and burst at high temperatures, creating honeycomb-like pores;
- Low oil absorption: The gluten-free network reduces fat adsorption, allowing for a reduction in fat content by 15-20%;
- Strong stability: Wide pH tolerance range (4-10), suitable for adding acidic flavor components such as fruit acids.

Health transformation

The global gluten-free food market is expanding at an annual growth rate of 11.5% (Grand View Research, 2023), with tapioca flour becoming the preferred choice for celiac disease patients and low-carb diet enthusiasts. For instance, a certain brand has launched tapioca-based sea salt biscuits that incorporate potato protein to enhance structural strength, achieving a 90% taste resemblance to gluten-containing biscuits.



Biscuit Forming Process

DOUGH MIXING MACHINE SOFT&HARD BISCUIT SHAPING MACHINE TUN
OVEN SPRAYING MACHINES COOLER

Multifunctional biscuit make machine process is a precise manufacturing procedure that integrates food science with mechanical automation. The entire production line, from material mixing to finished product packaging, is meticulously designed to ensure the product achieves optimal taste and quality standards.

The automatic biscuit production line begins with the flour mixing stage, which is carried out by professional mixers. The mixer combines high-quality wheat flour, fresh eggs, fine sugar, and various seasonings according to strict proportions. Through the rotational movement of dual stirring paddles, all ingredients are thoroughly blended. Modern mixing equipment typically includes temperature control systems that maintain the mixture's temperature

an ideal range, ensuring the dough has the perfect elasticity and consistency. After 1 minutes of thorough mixing, the uniform dough is automatically conveyed to the next

The shaping process varies depending on the product type. For hard biscuits, a rolling is used to press the dough through multiple rollers into uniform sheets of consistent thickness, which are then cut with specially designed molds that often feature various or innovative shapes such as circles, squares, or hearts, each meticulously crafted to precision and aesthetic appeal. Soft biscuits are shaped using a stamping machine, where the dough takes on patterns from engraved rollers, creating beautiful three-dimensional designs on the surface of the biscuits, which may include flowers, animals, or other intricate decorations, adding a touch of elegance and charm to each piece. During the shaping process, advanced visual inspection systems continuously monitor the shape integrity of each biscuit, automatically removing any substandard semi-finished products to ensure quality and consistency of the final product, maintaining the brand's reputation for excellence and customer satisfaction.

Baking is the crucial step that determines the final quality of biscuits. Tunnel ovens are designed with multiple temperature zones, through which biscuits pass through preheating, baking, and browning sections. The preheating zone maintains a temperature of 120°C with warm air gently enveloping the biscuits to initially set their internal structure, gradually making them soft and elastic; the baking zone increases the temperature to 180-220°C where high heat triggers the Maillard reaction, releasing rich aromas and causing the surface to turn a tempting golden color; finally, the browning zone precisely controls the surface color, adjusting temperature and time to achieve the ideal shade, ensuring the biscuits are not overly burnt while retaining their luster. Modern ovens are equipped with air circulation systems to ensure even temperature distribution within the oven, with a temperature difference not exceeding $\pm 3^{\circ}\text{C}$, allowing each biscuit to bake under optimal conditions, resulting in a crispy texture and fragrant aroma.

After baking, the biscuits undergo an oil spraying process that imparts a unique flavor and sheen. The automatic oil spraying system uses high-pressure atomization technology to evenly spray edible oil on the biscuit surface, with the amount of oil controlled by a precision metering pump to be between 0.5 and 1.2 grams per biscuit. Some premium products also add flavored oils or nutritional enhancers at this stage to increase their added value.

The cooling process is equally crucial, as freshly baked biscuits need to pass through a cooling conveyor belt that is 15 to 20 meters long. This specially designed conveyor system is equipped with temperature and humidity control devices, using a combination of natural convection and forced ventilation to gradually reduce the biscuit temperature from around 80°C to room temperature. During this process, moisture inside the biscuits continues to distribute evenly, ultimately achieving the ideal crispy texture. At the end of the conveyor

belt, a metal detector performs the final quality check.



What are the advantages of this line?

A complete soft and hard biscuit production line , which can make all kinds of biscuits in various shapes, just change the mold.

?Soft & Hard Biscuits: Adjust dough consistency, baking time, and temperature to produce soft, chewy, crispy, or layered biscuits.

?Multiple Shapes & Designs: Simply change the mold to switch between round, square, heart-shaped, animal-shaped, or custom-designed biscuits.

?Wide Recipe Compatibility: Works with various dough types, including sugar-based, savory, gluten-free, and high-fiber recipes.

The biscuit production line can be customized according to the customer's workshop size and biscuit making technical requirement

?Adaptable Layout: The machine can be adjusted in size, conveyor length, and configuration to fit small, medium, or large workshops.

?Tailored Technical Specifications: Customize baking time, temperature zones, and speed based on your biscuit type.

?Optional Add-ons: Additional modules like chocolate coating, cream filling, or double baking can be integrated.

Have different heating sources for your operation (Electric, gas, Diesel oil)

?Electric Heating: Best for stable temperature control, suitable for indoor factories with electricity supply.

?Gas Heating: Cost-effective for large-scale production with consistent heat distribution.

?Diesel Oil Heating: Ideal for areas with limited gas or electricity access, providing high thermal efficiency.

It is full automatic, advanced technology, easy to operation, high quality, save energy, labor, reasonable price to win customer reply and reputation.

?PLC Touch Screen Control: Easy-to-use interface for adjusting speed, temperature, baking time.

?Energy-Saving Design: Optimized heat circulation and insulation reduce power consumption.

?Minimal Labor Requirement: Automated feeding, forming, baking, and packaging reduce manual work.

?Smooth & Stable Performance: Precision-engineered components ensure low maintenance and long service life.

?In today's increasingly competitive biscuit industry, (company name) focuses on solving challenges in production and helps customers :

- a. Reduce energy costs
- b. Improve yield
- c. Gain small-lot flexible production capacity



This automatic biscuit production line, developed through the careful integration of advanced Japanese technology, features cutting-edge equipment design. It boasts a sleek, compact, and robust structure capable of withstanding rigorous daily operations while maintaining full automation. The line efficiently manages every step of the biscuit-making process, from evenly distributing dough during feed rolling to precisely shaping biscuits, followed by waste recycling, thorough drying, delicate coating, and final cooling, all in a seamless continuous operation. The feed rollers ensure the dough is uniformly spread, creating consistent thickness and texture. The shaping unit employs precision mechanisms to form various designs and patterns, enhancing the visual appeal of each biscuit. Waste recycling systems collect excess dough and re-integrate it into the production cycle, minimizing waste and maximizing efficiency. The drying phase utilizes gentle heat to achieve optimal moisture levels, ensuring crispness without compromising flavor. Delicate coating stations apply a variety of toppings, such as chocolate, sugar, or nuts, with pinpoint accuracy. The final cooling stage stabilizes the biscuits, preserving their shape and enhancing their shelf life. Users have access to hundreds of molds for various shapes and sizes, along with dozens of carefully crafted formulas, enabling versatile and customizable production. By simply changing the mold and adjusting the process recipe, manufacturers can easily produce a wide range of popular high-end biscuits with unique textures, rich flavors, and appealing appearances, catering to diverse consumer preferences. Each biscuit emerges from the line with a perfect balance of crunch and softness, inviting consumers to savor the delicious results.

combination of taste and texture.

The fully automatic biscuit production line achieves dual breakthroughs in efficiency and quality through precise process control, such as differentiated dough preparation, segmented temperature control during baking, as well as intelligent equipment like rotating molds. In the future, with the integration of low-carbon energy-saving technologies and personalized customization needs, biscuit production will evolve towards being more efficient and environmentally friendly.