

Fish Value Addition with Sous-Vide Technology

*Md. Aman Hassan, Parmanand Prabhakar, Pooja Saklani and Sarvendra Kumar
College of Fisheries, Kishanganj, Bihar Animal Sciences University, Patna, Bihar, India

*Corresponding Author's email: mdaman.hassan@gmail.com

Now a days Sous vide technology is a modern cooking technique, in which fish stick is vacuum-sealed and cooked in a water bath at a precisely controlled low temperature for an extended period. Originating in France, this low-temperature, long-time (LTLT) preservation technique ensures uniform cooking throughout the food without overcooking the exterior. It helps retain moisture, natural flavours, and nutrients while improving tenderness and juiciness, especially in protein-rich foods such as meat and fish. Sous vide is widely used in professional kitchens and is increasingly popular in home cooking due to its consistency, safety, and high-quality results.

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Introduction

Sous vide is a French term used for a cooking technique under vacuum conditions. It is usually in a vacuum bag and cooked in a water bath kept at a precisely controlled temperature. It is also known as low-temperature, long-time cooking. It is a method of cooking invented by the French chef Georges Pralus in 1974 in which food is placed in a plastic pouch or a glass jar and cooked in a water bath longer than usual cooking times (usually one to seven hours and more than three days in some cases) at a precisely regulated temperature. This technology is widely used in professional kitchens and is increasingly adopted in home cooking. The temperature is much lower than usually used for cooking, typically around 55 to 60°C (130 to 140°F) for poultry and higher for vegetables. The intent is to cook the item evenly, ensuring that the inside is properly cooked without overcooking the outside, while retaining moisture. It provides consistent and even cooking from edge to edge, as the food is cooked to the precise temperature of the water. This method is excellent for tenderising proteins, retaining moisture and flavour, and eliminating the risk of overcooking.

Processing method

1. Season and seal: Before sealing, the food, fish sticks are seasoned to enhance flavour. This may include:

- Salt and spices
- Herbs (fresh or dried)
- Marinades or citrus juices
- Aromatics like garlic, ginger, or pepper
- Small amounts of oil or butter

Sous vide cooking in a sealed environment enhances flavour infusion and reduces the need for added seasonings. Removing air is essential because it allows proper heat transfer between the water and the food. It prevents the bag from floating, which can lead to uneven cooking. It reduces oxygen exposure, helping preserve colour nutrients and shelf life.



Fig 1- Vacuum packed Fish stick

After removing air from the bag, is sealed tightly to prevent water from entering. Properly check to ensure there is no leak in the vacuum-packed product. Proper sealing is crucial, especially in studies involving the shelf life of the product.

2. Setting of temperature in water bath for cooking: In sous vide cooking, the food is cooked in a precisely controlled water bath rather than over direct heat. Proper controlled temperature in the environment, generally immersion circulator-type water bath is used. In an immersion circulator, heat the water to the specific required temperature (for example, 54°C for medium-rare steak or 60°C for fish) and circulate the water continuously to maintain uniform temperature throughout the container. Traditional cooking uses much higher temperatures, which can overcook the outside while the inside remains undercooked. Sous vide uses the exact final temperature you want the food to reach, so it cannot overcook. Even delicate foods (like fish) maintain perfect texture because they are not exposed to intense heat. Thermal control is essential for achieving the high-quality, constant results that sous vide cooking is known for, especially in research involving the quality and shelf life of sous vide products. Temperature and time are precisely maintained to ensure even cooking and food safety. After cooking food is not serving immoderately, then cool the pouches rapidly in an ice bath, which prevents microbial growth and preserves texture. Food can be stored at 0-3°C for better shelf life.



Fig 2- Immersion Circulator Water Bath

Table 1- Cooking Time-Temperature in Sous-Vide Technology

S. No	Product	Temperature (°C)	Time
1.	Fish	45-60	20 minute -1 hours
2.	Meat	54-74	1-4 hours
3.	Poultry	60-75	1.5-4 hour
4.	Vegetables	80-90	12-48 hours

3. Serving: After completing the sous vide cooking process, the food is removed from the vacuum-sealed pouch and gently patted dry to eliminate excess surface moisture. It is then finished with a quick, high-heat sear in a hot pan, on a grill, or using a culinary torch. This step helps develop a rich, browned exterior and enhances flavor through the Maillard reaction. Although this searing step is not part of the sous vide cooking itself, it is essential for improving the appearance, aroma, and overall eating experience of the dish.

Advantages of sous vide technology

- **Consistent Results:** The precise temperature control ensures the entire food item is cooked to the desired doneness, with no overcooked edges or undercooked centers. This makes it a staple in professional kitchens for repeatable quality.
- **Enhanced Flavor and Texture:** By cooking in its own sealed juices, food retains moisture and natural flavors, resulting in exceptionally tender and juicy results.
- **Nutritional Value Retention:** The lower cooking temperatures and sealed environment minimise the degradation of heat-sensitive vitamins, minerals, and antioxidants often lost in traditional high-heat cooking.
- **Operational Efficiency:** For commercial use, food can be prepared in advance, rapidly chilled, and stored until needed, streamlining kitchen workflow and reducing waste.

Safety and Limitations of the Products

- **Food Safety Concerns:** Cooking at low temperatures can pose a risk if not managed correctly, as some pathogenic bacteria like *Clostridium botulinum* can grow in oxygen-free, low-temperature environments. Strict adherence to time-temperature guidelines (HACCP principles), rapid chilling, and proper cold storage are essential safety measures.

- **Lack of Browning (Maillard Reaction):** The low temperatures typically used in sous vide do not achieve the browning (Maillard reaction) needed for a flavorful crust on meats. Therefore, a quick sear in a hot pan or with a torch is often performed after the sous vide process.
- **Equipment Cost:** While home devices are now affordable (e.g., immersion circulators), professional and industrial equipment can be costly.

Overall, sous vide technology offers a method to achieve culinary results that are difficult to replicate with conventional cooking, blending scientific precision with gourmet quality.

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