

The Sous Vide Revolution: Coming Full Circle and Beyond

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For the purpose of this research, academic material and online sources were utilised to clarify the meaning of the key term *sous vide*.

The Sous Vide Advisory Committee (1991) says ‘Sous Vide (also known as *Cuisine en Papillote*) is an interrupted catering system in which raw or par-cooked food is sealed into a vacuumised laminated plastic pouch or container, heat treated by controlled cooking, rapidly cooled and then reheated for service after a period of chilled storage’. According to Herbst (1995), the term ‘refers to a cooking method of French origin and directly translates into “under vacuum”’. In the words of Escolar (2008), it is ‘a temperature precise poach utilizing vacuum sealed product’; while Baldwin (2009) calls it ‘a method of cooking in vacuumised plastic pouches at precisely controlled temperatures’.

Recently published books (Myhrvold et al. 2011; Stampfer 2009; Keller 2008) featuring the method would suggest that the process has seen an increase in popularity over the last number of years.

Advances in food science with regard to the food-manufacturing industry and the interest by an increasing number of chefs to take a scientific approach to cooking has helped to advance the *sous vide* method as part of modern food production. In the catering sector, especially high-end gastronomy, it has gained substantial momentum for its benefits, such as aromatic, textural, and nutritional improvements (Costa and Sarkar 2008).

Secondary research was carried out to establish a comprehensive knowledge on the subject area of *sous vide* cookery, including advantages, disadvantages, methods and strategies. In order to explore the possible popularity of *sous vide* cooking in high-end restaurants in Ireland, the author contacted two chefs of Irish Michelin starred restaurants who are applying the method extensively:

- Chef owner Ross Lewis of Dublin’s, Michelin starred restaurant ‘Chapter One’
- Chef owner Enda McEvoy of Galway’s, Michelin starred restaurant ‘Loam’

Precursors to the *sous vide* method

Long before the availability of plastic, food was prepared by wrapping it in paper and cooking it, a method called *en cartuccio* in Italian and *en papillote* in French (Scarpa 2003).

The German, Otto von Guericke started working on a vacuum pump in 1647 which he demonstrated to great effect in 1657 with the Magdeburg hemispheres. Denis Papin based on Guericke’s vacuum pump carried out experiments around 1670 in which he attempted to use the

process of vacuum sealing with the aim of preserving food (Lienhard 2006).

In 1804 François Nicolas Appert developed a method of food preservation by heating sealed glass bottles in boiling water. This method was later optimised and patented in the US in 1858 by John L. Mason with screw-top glass jar known today as Mason Jars (Greenbaum and Rubinstein, 2012). Another patent was submitted in Germany in 1892 by Rudolf Rempel, a doctor of chemistry who preserved food in glass jars using rubber bands.

Only a small step was missing for the development of *sous vide*, but this would take almost another hundred years. With advances in the technology of plastic materials and vacuum sealers, the first food products were vacuum-packed in plastic pouches in the 1950s, which paved the way for the *sous vide* concept (Stampfer 2009).

The evolution of *sous vide* cooking

There are many different opinions as to where *sous vide* cooking started, either in food manufacturing or in the restaurant sector. According to Hesser (2005), the *sous vide* method has been used since the late 1960s and was first and foremost used to vacuum-pack and pasteurise industrial foods to achieve a longer shelf life. However, Kornmayer (2010) states that *sous vide* technology was developed first between 1970 and 1974 by the French chef George Pralus (1985), who was looking for a way to reduce the shrinking of force-fed goose liver during cooking. Due to the high fat content, the liver was losing forty percent weight using traditional cooking methods. Cooking the same liver *sous vide* at a low and precisely controlled temperature, reduced the weight loss to five percent, and the flavours improved significantly.

Simultaneous with Pralus, the scientist Bruno Goussault was working on the *sous vide* concept in the early 1970s, searching for a way to cook roast beef more tender. He achieved this by hermetically sealing the product in specially designed pouches and lowering the temperatures during cooking (Hesser 2005).

In France in the 1980s, Bruno Goussault teamed up with Michelin three-star chef Joël Robuchon to create the first *sous vide* meals for first-class passengers travelling on the TGV (Hesser 2005). Goussault published scientific papers based on his research into the *sous vide* method, and worked extensively with different companies in France driven by his desire for culinary problem solving using the application of scientific methods. One of these companies was a bakery chain called Vie de France. When they

approached Bruno Goussault, the company was looking for new thaw-and-bake methods. The CEO, Stanislas Vilgrain, was so impressed with Goussault's scientific approach to cooking-related problems that he decided to take the bakery into a totally new direction. They built their first small sous vide plant in the late 1980s, followed by one in America in 1990 and others in Chile and France. This was the start of the company Cuisine Solutions (Kliman 2010).

In America even after all the published research it took more than two decades for the method to gain acceptance. In 1988 Cuisine Solutions, called *Vie de France* originally, was just in the process to substantially increase their sous vide operations, as an article appeared in the *Washington Post* that questioned the safety of sous vide cooking and some food-storage techniques like modified-atmosphere packaging, which were new methods at this stage (Hesser, 2005).

Also in 1988, the use of sous vide cooking by restaurants and hotels was called into question by Food and Drug Administration in the United States. This government body was concerned that smaller businesses may not use the method in a risk-eliminating way and therefore may 'pose a significant threat to public health'. The difficulty of temperature control during the distribution of sous vide products, is a problem which eventually led to the frozen distribution of sous vide ready meals to hotels and caterers (Creed 2000).

Bruno Goussault started working more intensively with the American branch of Cuisine Solutions in 1998 and joined the company headquarters in Alexandria in 2001 to become its Chief Scientist (Kliman 2010). According to Thrush (2007), Cuisine Solutions had fifty percent of their business whipped out overnight after the terrorist attacks 11 September, 2001, as the business of hotels, airlines, and the tourism industry as a whole collapsed. The company had to find new ways to diversify. Within three years, the company had turned around by working with the US military and by launching a retail line. It was during this time, that Stanislas Vilgrain took Bruno Goussault's advice and allowed Goussault to train chefs around the world in sous vide techniques. This agreement was to mark a turning point in the way sous vide would be used, especially in the restaurant sector.

Hesser (2005) argues that Goussault's impact on cooking was greater 'than anyone since Escoffier'. Bruno Goussault trained most of America's Michelin-starred chefs, such as Charlie Trotter and Thomas Keller, in using the sous vide method (Kliman 2010). Cuisine Solutions' rapid growth surpassed the expectations of its founders with \$90 million in annual sales solely based on sous vide and by producing between '100,000 to 130,000 fully cooked, pasteurised, and then frozen meals a day' (Hesser 2005). Even at this stage, other hurdles in the use of sous vide in the restaurant sector would have to be overcome.

Parseghian (2006) and Prewitt (2006) both state that the New York City Department of Health and Mental Hygiene (DHMH) banned the city's restaurants from

using sous vide methods on grounds that the method of cooking was a food-manufacturing process which chefs had not been taught in catering colleges. According to health officials, the anaerobic conditions present during the sous vide process combined with the temperature during cooking, as low as 60 °C, posed a significant risk to the public if restaurants using the method did not follow the right procedures with regards to time, temperature, speed of cooling, and storing temperatures. Not following the right procedures can create an ideal breeding environment for botulism and listeria (Bensky 2007). In 2006, the DHMH started to work on guidelines for sous vide cooking. Prior to the publication of the guidelines, restaurants that wished to continue to use the technique were required to provide a HACCP plan for each food item supported by a consultant with a degree in microbiology or food science (Bowen, 2006). This was a costly and time consuming process. This incident showed that even though the method had been used for decades, there were no proper regulations in place to deal with the sudden increase in sous vide cooking in restaurants, and that staff did not have the appropriate training (Parseghian 2006).

According to Costa and Sarkar (2008), around the middle of the first decade of the twenty-first century, another factor that influenced the rise of sous vide in Europe was the cooking based on 'Molecular Gastronomy' with high-profile chefs such as Ferran Adrià of *El Bulli* in Spain and Heston Blumenthal of *The Fat Duck* in the UK as ambassadors (This 2005). These two chefs had a cooking style which was described as the 'science of deliciousness' and was also known as 'new cookery' (Adria et al. 2006). Adrià and Blumenthal's approach to cooking by incorporating technology from industrial applications as well as the use of the latest research in food science, resulted in 'hypermodern cuisine' (Pontin 2005). It was their determination and dedication to use technology to achieve better flavour and texture in foods which fuelled the progress made with sous vide equipment (Bos 2008).

Prior to Adrià and Blumenthal, centralised food production in large-scale catering and food manufacturing had become more prominent. With both sectors facing huge challenges, the need arose to:

- transport prepared and cooked foods over great distances;
- keep food free of contamination and spoilage during preparation, storage and distribution by creating a biological barrier;
- retain vitamins and minerals during cooking within the food to make it more nutritious;
- be competitive by controlling the raw material costs;
- be efficient and control labour costs;
- deliver consistent quality.

Sous vide cooking could provide many answers to these challenges, but there were also disadvantages associated with it, and if not used in the right way, it could pose a threat (Creed 2000).

Advantage	Sources
Reduction in oxidation is achieved as food is vacuum-packed and therefore oxygen is removed, helping to maintain the original conditions of the food.	Creed and Reeve (1998) Costa and Sarkar (2008) Myhrvold et al. (2011)
Sealed plastic pouches prevent leaching and create a biological barrier eliminating the risk of recontamination during storage, cooking, cooling and reheating.	Creed and Reeve (1998) Costa and Sarkar (2008) Rodgers (2008) Myhrvold et al. (2011)
Sealing of products as well as the low temperatures during cooking reduce the loss of moisture, nutrients, vitamins, volatile flavour and odour molecules compared to conventional methods.	Costa and Sarkar (2008)
Less salt, spices and herbs are needed as their contributions to the food are intensified using sous vide cooking, making it very suitable for a low-sodium diet.	Costa and Sarkar (2008)
Cheap cuts of meat will be tenderised due to low-temperature cooking over a long period of time, by gently breaking down the connective tissue, and at the same time maintaining the juiciness of the product.	Rodgers (2008) Coulate (2008) Baldwin (2012; 2009) Myhrvold et al. (2011)
The sous vide process can help to introduce a time buffer increasing efficiencies in food production, as well as achieving an extended shelf life if strict guidelines are followed.	Creed and Reeve (1998) Myhrvold et al. (2011)
Cooking food at its ideal desired core temperature eliminates carry-over cooking as well as reducing the temperature gradient, especially associated with cooking meats. Conventional cooking methods would result in a gradual change from overdone on the outside to the desired doneness in the centre. Using sous vide the desired doneness is achieved throughout the meat.	Chu (2010) Myhrvold et al. (2011) Baldwin (2012; 2009)

Table 1: Advantages of the sous vide process (Hoeche 2013)

Disadvantages	Sources
Expensive equipment is needed, such as vacuum chamber sealers and very accurate temperature-controlled water baths, Additional highly accurate cooling and chilling equipment may be required, as the cool down times and temperatures are very strict and the storage of foods prepared sous vide has been recommended to be below 3 °C.	Creed and Reeve (1998) Ghazala (2004) Rodgers (2008) Gormley and Tansey (2012)
For industrial food manufacturing the start-up costs are substantial, and maintaining and controlling conditions during each process require expensive high-tech equipment.	Rodgers (2008)
An additional cost factor is the food-grade, heat-stable plastic pouches.	Creed and Reeve (1998)
As food is cooked at its ideal temperature, the time factor needed to reach the desired temperature throughout the product has to be taken into consideration, as it will take a lot longer using sous vide to reach the desired temperature compared to traditional cooking methods.	Chu (2010)
The caramelisation called 'Maillard Reaction' which takes place during roasting meat, or the crispness of fish skin, is not achievable using sous vide as the temperatures required are well above 150 °C.	Bos (2008)
Restaurants using sous vide extensively may need a high quantity of temperature-controlled water baths, using up a lot of space, as different types of food require different temperatures for cooking using sous vide.	Chu (2010)
Low temperature and reduced oxygen during cooking as well as cooling times and storage temperatures are a cause of safety concerns.	Bolton (1998) Hyttiä-Trees et al. (2000) Ghazala (2004) Baldwin (2012; 2009) Gormley and Tansey (2012) Betts (1992)

Table 2: Disadvantages of the sous vide process (Hoeche 2013)

Advantages and disadvantages

In order to explore if sous vide has influenced and revolutionised the way food is being cooked today, advantages and disadvantages need to be identified. The Tables 1 and 2 comprise a summary of these advantages and disadvantages.

Sous vide methods and strategies

The ways in which sous vide are used today have been explored in detail by Baldwin (2012 2009) and Myhrvold, et al (2011), with the former differentiating between industrial food processing and the restaurant kitchen as shown in Fig. 1.

Both sets of authors state that cook-serve and cook-hold-serve are the simplest and safest ways to use the sous vide process. Baldwin recommends pasteurisation for both strategies apart from food held between 21 °C and 55 °C for less than one hour which represents a time-temperature combination compatible with consumption without refrigeration. Myhrvold, et al, recommend pasteurisation only for products that include a chilling step. All authors agree though that the most widespread method applied is cook-chill and cook-freeze, which individually requires pasteurisation of the product. Both authors provided a general guideline, which however does not take into account the different intrinsic characteristics of foods. Therefore it would be advisable to adapt protocols with the knowledge of the various product characteristics (e.g. microbial load, water activity, pH, etc.).

The different sous vide strategies are

Cook → Serve

Cook → Hold → Serve

Cook → Chill → Reheat → Serve

Cook → Chill → Freeze → Defrost → Reheat → Serve

Adapted from Baldwin (2012); Myhrvold et al. (2011)

Sous vide in Ireland

Report regarding sous vide cookings, such as 'The Microbiological Safety and Quality of Foods Processed by the Sous Vide System as a Method of Commercial Catering' (Bolton 1998), 'Sous Vide – An Overview of the Process' (Creed 2000), and 'Developing Sous Vide/Freezing Systems for Ready-Meal Components' (Tansey et al., 2005), have been published in Ireland. These reports are aimed at industrial food manufacturing or large scale commercial catering rather than small-scale operations like restaurants.



Fig. 1: Flow diagram, sous vide cooking. The branches in red and green (the rightmost three) are common in both restaurants and home kitchens while industrial food processors only use the branches in blue and green (the leftmost three). The branches in red (the rightmost two) should only be served to healthy immune-competent people and in the rightmost branch; they should understand and accept the risk. (Baldwin 2012).

McKenna (2011) predicted a 'Hi-Tech, Low-Concept' approach with regard to food trends for 2011, suggesting an increase in methods like sous vide cooking being used in Irish restaurants. This point was reflected by the publication of a Factsheet regarding the sous vide cooking method by the Food Safety Authority of Ireland (2014) that aimed to address the risks 'due to a rise in the use of sous vide cooking in restaurants and catering establishments' (FSAI 2015).

Sous vide in two Irish, Michelin-starred restaurants

Both Irish chefs were asked: 'Did sous vide change the way you cook today, and if so how?' The responses by the two chefs yielded additional information not discovered during secondary research. Both suggested that sous vide cooking has influenced and changed the way each chef cooks today:

Sous vide cooking has given chefs a greater understanding of how proteins coagulate at certain temperatures. It has added an unprecedented element of control to cooking which is so important in high-end restaurants, allowing us to remove the element of human error. The close proximity of the main ingredient to spices, herbs and other

components like rinds of citrus fruits allows for excellent transfer of flavour while using very small quantities, therefore reducing the overall cost of cooking (Ross Lewis, Chapter One, Dublin).

The footprint of sous vide cooking equipment is much smaller compared to traditional ovens, allowing chefs to better utilise the space in their kitchens. It is possible to achieve a great variety of textures in products depending on the variables of time and temperature. The method delivers great consistency for example when cooking eggs. It is pretty fool proof as one can apply step-by-step procedures. Sous vide [cooking] is a very clean method of cookery and the product packaging allows for easy cooling in iced water rather than using bulky and quite expensive blast chillers (Enda McEvoy, Loam, Galway)..

Sous vide in the domestic kitchen

It is only very recently that sous vide cookery has found its way into the home. Poly Science immersion circulator had been available to the home cook for some time, but it was with the first domestic appliance, like the Sous Vide Supreme, which entered the market in 2009 that prices became more affordable. This price drop in combination with the desire to recreate high-end restaurant food at home has produced an increase in sales of domestic sous vide equipment. It is the application of this precise and controlled method of cookery that makes it attractive to the enthusiastic home cook. It provides them with tools to achieve unprecedented consistency and quality. There are two other contributing factors like be the number of cooking programs on TV making use of the technique and the books that have been published in recent years (King, 2012; Manjoo, 2014). In addition there are currently a number of applications (apps) available for tablets and smartphones dedicated to sous vide cooking such as 'Sous vide Dash', 'Sous Vide Celsius' and 'Poly Science Sous vide Toolbox' enabling the home cook to determine the optimal sous vide cooking time and temperature for a variety of foods.

Conclusion

The literature has demonstrated that sous vide cooking is not a new method, but a development of a process over the last forty years that has its roots in traditional methods of cookery using modern materials and technology. Both secondary and primary research suggests that sous vide cooking has revolutionised food manufacturing as well as large-scale catering and some areas of the fine-dining restaurant sector.

It is only lately that the full potential of sous vide cooking has been realised. As the equipment needed for the method becomes easily available and prices fall, the benefits of sous vide cooking implemented by well-educated

professional cooks and enthusiastic home cooks outweighs the disadvantages and dangers associated with the process. Only time will tell if the recent movement of sous vide cookery into the domestic kitchen will continue.

One of the questions that remain is if the sous vide method of cooking removes classical cooking skills from young, professional cooks, a point recently raised by Michel Roux, Jr. He said that he was 'saddened by chefs who only know vacuum pouches and water baths. You take them out of that environment and they just cannot cook – it's shocking'.

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