PROCESSING AND PACKAGING OF HEAT PRESERVED FOODS

Edited by J. A. G. Rees and J. Bettison

Blackie

Processing and Packaging of Heat Preserved Foods

Edited by

J.A.G. REES
and
J. BETTISON,

CMB Packaging Technology,
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Processing and Packaging of Heat Preserved Foods

Preface

Why, when we are almost at the end of the second century in which foodstuffs have been packaged and heat processed, do we need another book on the subject? The food industry is in a state of change; consolidation, regrouping and merger have removed the elements of specialisation and without doubt have accelerated the transition of food processing from an art to science and technology. There are many driving forces for change. Today new pressures in the market place from the retailer and consumer, together with the strong driving forces for safety and protection of the environment, demand the involvement of the whole of the food chain.

The packaging of foods represents a partnership between the food processor and the package manufacturer. The subject is not taught in the same way as the other elements of science and technology that are involved in the food chain, yet today it represents big business and, in the case of heat-preserved foods, is an integral and indispensable part of the total process.

This book will introduce the major food packages, processes and good manufacturing practices to the reader. It aims to transfer knowledge and the experience of many years of practice (in the case of metal containers, the details of manufacture and surface coating are unique to this publication). It also looks to the future, bringing together, for the first time in one volume, those elements critical to the heat preservation of foods.

The book is aimed at the new graduate entrant to the food industry and those production personnel engaged in good manufacturing practice, quality control and engineering. Personnel employed by the material suppliers (for example, in the steel and plastics industries) and the materials converters (the packaging industries) will find that the book provides a useful insight into the technologies involved in heat preservation. The prime objective of the book, however, will be to direct the reader to the delivery of safe and nutritious food to the consumer.

J.A.G.R
J.B

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Contributors

J. Bettison CMB Packaging Technology, Denchworth Road, Wantage OX12 9BP, UK.

K.L. Brown Campden Food and Drink Research Association, Chipping Campden, Gloucestershire GL55 6LD, UK.

M.N. Hall Campden Food and Drink Research Association, Chipping Campden Gloucestershire GL55 6LD, UK.

K.A. Ito National Food Processors Association, 6363 Clark Avenue, Dublin, California 94568, USA.

R.J. Pither Campden Food and Drink Research Association, Chipping Campden, Gloucestershire GL55 6LD, UK.

P.J.G. Proffit Neste Chemicals International, Bazellan 1, B-1140, Brussels.

J.A.G. Rees CMB Packaging Technology, Denchworth Road, Wantage OX12 9BP, UK.

P.S. Richardson Campden Food and Drink Research Association, Chipping Campden, Gloucestershire GL55 6LD, UK.

B.J. Rushbridge CMB Packaging Technology, Denchworth Road, Wantage OX12 9BP, UK.

J.D. Selman Campden Food and Drink Research Association, Chipping Campden, Gloucestershire GL55 6LD, UK.

K.E. Stevenson National Food Processors Association, 6363 Clark Avenue, Dublin, California 94568, USA.

R.H. Thorpe Campden Food and Drink Research Association, Chipping Campden, Gloucestershire GL55 6LD, UK.

T.A. Turner CMB Packaging Technology, Denchworth Road, Wantage OX12 9BP, UK.

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1 Introduction

J.A.G. REES

1.1 Current market size

Over £1500 million worth of canned food is bought in the United Kingdom every year [1]. Over 7.5 billion cans are consumed, 1.5 billion of which are imported into the United Kingdom (Table 1.1). In the United States, the value of heat processed shelf stable foods in 1987 was approximately $18 billion. This figure includes cans, glass jars and aseptic cartons and was supplied by a census of over 1100 establishments of US manufacturers [2].

These figures demonstrate the continued popularity of heat processed foods and in particular the can. Contrary to what some may believe, the sales of canned food are forecast to show continued growth over the next decade with fruit, vegetable and fish products likely to show the greatest increases.

In addition to the traditional established forms of heat processed containers, the can and glass jar, new ones are emerging. Plastics containers have been commercially introduced, both in the United States and Europe for ready meals (Figures 1.1, 1.2). One significant success in the United States has been a 4 oz container for aseptically packed apple sauce; 500 million units were packed in 1988 (Table 1.2) [3]. In the United Kingdom, sales of a 125 g container for pet food have risen from zero to tens of millions in less than 2 years.

1.2 Consumer trends

Entering the 1990s, consumers are demanding foods which they perceive as being

- Better nutritionally
- More 'natural'
- Offering more convenience, better suited to fast moving life styles
- Safe, with high integrity

Better nutrition was associated initially with lower calories. The food manufacturers are now addressing the consumers' need for more specific health requirements. Higher fibre content, lower fat, low sugar, low salt, no additives or preservatives etc. are all featured in heavy promotional advertising.

Table 1.1 Current value of UK canned foods, 1987.

Market sector	Value (£ million)	Percentage of market
Meat products	280	18.5
Vegetables	238	15.5
Baked beans	195	12.9
Fruit	192	12.7
Fish	186	12.3
Soup	168	11.0
Milk/desserts	122	8.0
Pasta	78	5.1
Cooking sauces	62	4.0

Source: [1].

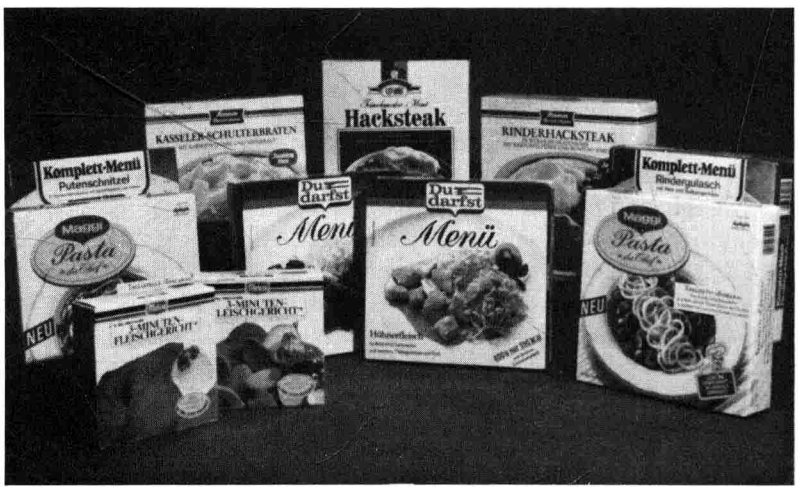

Figure 1.1 Shelf stable heat processed products (Plastic Containers, Europe).

'Natural' is usually associated with 'fresh' which in turn is usually associated with short shelf-life, perishable foodstuffs. 'Organic' foods i.e. foods grown without chemical fertilisers are starting to appear in our retail outlets.

The need for more convenient packaged foods has seen the growth of products targeted specifically at the domestic microwave oven. The penetration of these ovens in homes in both the United States and Europe has been rapid and continues to grow. In 1989, penetration of microwave ovens in US households reached 80%; sales of prepared and packaged foods targeted for the microwave oven exceeded $7 billion and are predicted to rise to $60 billion by the end of the century. One of the significant product growth areas has been in the development of ready meals in high barrier plastic trays specifically aimed at microwave reheating in the home.

Figure 1.2 Shelf stable heat processed products (Plastic Containers, USA).

Table 1.2 Multi-layer rigid barrier packaging market, 1988.

Application	Package	End users (partial)	MM units	Material use (MM lb)
Apple sauce	4 oz PP/EVOH or styrene/PVDC	Motts Musselman's Hunt-Wesson	500	6.5
Fruit juice	6 oz styrene/ PVDC	Ocean Spray Wyler's Slush	100	1.0
Puddings, sauces	4 oz PP/EVOH or PP/PVDC	Hunt-Wesson Kraft (Cheez-Whiz)	300	3.5
Entrées (retorted)	8 oz PP/EVOH bowls	Dial 'Lunch Bucket' Hormel AHF (Chef Boyardee)	100	4.0
	8 oz PP/EVOH cans	Hormel Ross Labs	25	1.0
	9–13 oz PP/EVOH or PP/PVDC trays	Hormel (Top Shelf) Del Monte Campbells Magic Pantry	100	5.5
Total			1125	21.5

Source: [3].

Fast food restaurants have achieved rapid growth again reflecting the attempt to satisfy our fast moving life styles. The scientist and technologist should always remember, however, that while we should respond to the needs and challenges of the market, safe processing and packaging remain the prime requirements.

The potential for food poisoning is of major concern. In Europe recently, problems of *Salmonella* contamination in eggs and *Listeria* in chilled cooked patés and sliced meats have focused attention on the risks to health. Canned foods have been associated with food poisoning but fortunately the incidence has been very low. The consumer will continue to demand that the industry delivers absolutely safe products.

1.3 Function of the package

The traditionally accepted functions of the package are that it should contain, protect, inform and attract. Today cost factors and legislative and environmental constraints are of paramount importance and to the traditional functions must be added those of environmental acceptability while meeting all of these requirements at minimum cost.

For most food products the over-riding objective is to ensure that the package will provide the optimum protective properties to preserve the product it contains in good condition for the anticipated shelf-life.

Physical and mechanical protection for the product must be afforded by the package to prevent damage, infestation, contamination, moisture pick-up, etc. For all methods of food preservation the package is an integral part of the process. In thermal processing, microbiological protection must also be afforded through the provision of a container of high integrity with a hermetic closure.

Container/product compatibility is of extreme importance. The specification for the package, while retaining physical and microbiological integrity, must not bring about any deterioration in the organoleptic characteristics of the contained food or obviously endanger the public health. These requirements are now mandatory in the United Kingdom by 'The Materials and Articles in Contact with Food Regulations 1987'.

Quality management procedures are therefore vital in the initial selection and subsequent use of container specifications for food packaging. Different packaging materials have different significant components, whilst the food and the environment in which it is sold and distributed may be similar. With metal containers, the selection of the correct container specification is critical to minimise corrosion with subsequent trace metal pick-up by the product. Similarly container and closure construction is important to prevent leakage, both physical and microbiological.

Flexible containers have detailed specifications for laminate performance

and seal integrity, together with strict definitions for the amount of extractable material permissible under specific test conditions.

Rigid plastic containers again have to conform within fairly tight limits regarding plastic monomer content. For specific uses, e.g. where they are used for the packaging of dairy products, the empty containers have to be manufactured under strict conditions of hygiene so that they are supplied to the industry with good microbiological integrity.

Packaging for the food industries has therefore to satisfy many requirements which are subject to quality control during manufacture. The assurance of this quality is essential to the growth of both the packaging and food industries.

1.4 Selection of the package

The food packaging and processing industries are dynamic, constantly evolving and developing in response to market needs, increasing raw material costs and environmental pressures. The choice of container, food processing and preservation process is increasing. How then, when required to make selections, may the reader make the optimum choice? Experience leads one to the fact that no decision has ever been made objectively, since there are varying wants, needs, wishes and desires which influence decision. Package selection is after all a compromise between, in basic terms, performance and cost.

In the Western world we all have enough food to exist. We enjoy regular supplies of high quality foods and the spending of significant levels of discretionary income is common in our lifestyles. New product development will be influenced by demographic trends, 'fashion', etc. It should always be remembered, however, that the consumer's perception of quality and value for money is the only criterion for successful establishment of a new product.

Consumer perception is, as previously discussed, paramount. Assuming a new product has been developed, how do we select the optimum route through to production?

1.4.1 *Choice of container*

The choice of container will largely be dictated by:

- Ease of handling
- Speed of filling
- Ease of closing
- Ease of processing
- Shape/design
- Printing/labelling
- Required shelf-life