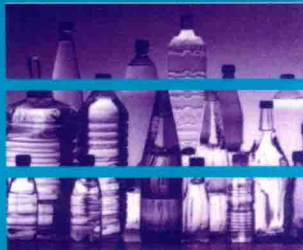


TECHNOLOGY OF BOTTLED WATER



*Edited by
Dorothy A.G. Senior
and Philip R. Ashurst*

Technology of Bottled Water

Edited by

DOROTHY A.G. SENIOR
Technical Services Manager
Highland Spring Ltd
Blackford, Perthshire

and

PHILIP ASHURST
Dr P.R. Ashurst & Associates
Consulting Chemists
Kingstone, Hereford

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Technology of Bottled Water

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A series which presents the current state of the art of chosen sectors of the food and beverage industry. Written at professional and reference level, it is directed at food scientists and technologists, ingredients suppliers, packaging technologists, quality assurance personnel, analytical chemists and microbiologists. Each volume in the series provides an accessible source of information on the science and technology of a particular area.

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Preface

The number of books written about the chemistry, technology and engineering of water is legion. Of these, however, only a very small proportion will have been written about bottled water, and it may just be that this volume is unique in providing an overview of an industry that has become a vigorous and vital sector of the beverage world.

There will be those for whom bottled water has always been important. Typically such consumers will have lived on the European mainland where the average annual per capita consumption is in excess of 100 litres. In other countries, typified by the UK, older consumers will not have seen, let alone have used, bottled waters in their childhood; this market, which has developed in the past 25 or 20 years, is even now only a fraction of that in other countries.

Whether consumption is large or small, bottled water is now important in most parts of the world and substantial industries have built up around it. Superficially, there may be a perception that, because water is so commonplace, there is little or no technology involved in bottling it. In fact, the reverse is true: because water is so sensitive to chemical, physical and microbiological contamination, it is one of the more difficult products to produce to a consistently high standard.

This encapsulates the rationale for the present work, which seeks to provide a good grounding in all the principal aspects of bottled water production. It is a book which will appeal to those working in all parts of the water bottling industry — engineers, technologists as well as marketing and commercial personnel. Just as important is the wider market for those who wish to learn about the industry — for example, suppliers of equipment and packaging, law enforcers, new graduates entering the industry and those with a reasonable technical background who are just curious.

The volume, after a brief introduction, starts with a review of the markets for bottled water and follows with a detailed description of the various categories of bottled water that are available.

Two chapters then deal respectively with the complex subject of hydrogeology and the treatments that can be used for processing water. The volume goes on to discuss the methods and materials of water bottling and the equipment used together with important related topics, including quality assurance and third party auditing.

There is a chapter on a specialised aspect of bottled waters — water coolers, which are becoming widespread in offices, factories, institutions and, in some markets (notably the USA), homes as well.

Finally, two chapters are devoted to the issues of microbiology — one focusing on untreated waters from groundwater sources and the other on treated waters.

In certain instances within the book, the word 'bottle' is used to include or describe any or all types of package, whether bottle as such or can, carton, etc.

The editors are, as always, greatly indebted to the authors. They are all extremely busy people and, in their own fields, eminent specialists from around the world. The combination of their contributions to this volume will, we are confident, produce a work that fills a significant gap in the market.

The shortcomings of the volume are the responsibility of the editors, but we hope that the overall efforts of editors and the authors will be welcomed by those who have bemoaned the absence of a work of this nature.

We are, by way of acknowledgement, grateful to Sue Bate for her help with the organisation of the manuscript.

Dorothy Senior

Philip Ashurst

Contributors

Dr P.R. Ashurst	Dr P.R. Ashurst & Associates, Kingstone, Hereford, UK
Mr M. Barnett	Hydropure Group, Hydropure House, Alington Road, St Neots, Cambridgeshire, UK
Professor Henri Leclerc	Laboratoire de Microbiologie, Faculté de Médecine, 1, Place de Verdun, 59045 Lille Cedex France
Professor M.S. da Costa	Departamento de Bioquímica, Universidade de Coimbra, 3000 Coimbra, Portugal
Mr N. Dege	Perrier Vittel UK Ltd, Station Road, Buxton, Derbyshire, UK
Professor S. Edberg	Department of Laboratory Medicine and Internal Medicine, Yale University School of Medicine, New Haven, CT 06520, USA
Mr D. Finlayson	Zenith International Ltd, 7 Kingsmead Square, Bath, UK
Mrs D. Senior	Highland Spring Ltd, Blackford, Auchterarder, Perthshire, UK
Mr M. Streetly	Entec UK Ltd, 160–162 Abbey Foregate, Shrewsbury, UK
Mr A.M. Tanner	NSF International, Avenue Grand Champ 148, 1150 Brussels, Belgium
Mr F.G. Vickers	Krones UK Ltd, Westregen House, Great Bank Road, Wingates Industrial Park, Westhoughton, Bolton, UK
Dr M. Walters	Entec UK Ltd, 160–162 Abbey Foregate, Shrewsbury, UK
Mr M. Wayman	First Effluent Ltd, 42a High Street, Sutton Coldfield, West Midlands, UK

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1 Introduction

Philip Ashurst and Dorothy Senior

1.1. General introduction

Water is essential to humans and, indeed, to all plants and animals. It is, however, the supply of bottled water to humans that is the concern of this volume. To most people, water is readily available at the turn of a tap. In many countries, running water is available in every home and place of business, and only in the least developed parts of the world is the tap a communal resource. In a very few countries, water is only available from a river, well or spring. In the developed world, not only are we used to water in every home but it is water that is distributed fit for all domestic purposes and is essentially safe to drink.

The ready availability of piped water prompts speculation about the popularity of bottled waters, because the volume of water consumed in this way is very large and shows steady growth in many countries. The consumption of bottled water in different parts of the world is driven both by historical and geographical situations, and by the effects of lowered water tables and ever-increasing contamination of water supplies from the human activities of agriculture and industry and otherwise from the environment.

In Europe, the consumption of bottled water in, for example, both France and Italy has been substantial because there is a history of readily available water supplies offering, generally, natural mineral water of excellent quality when compared with the public water supply. In the United Kingdom, on the other hand, there was a legacy of water supply from the hygiene-conscious Victorians. Water to almost all parts of the kingdom was of the highest quality and only in the past two decades has there been a measurable deterioration in water quality. This has arisen because of the increasing demand for water, and the widespread contamination of water courses with discharges, fertilisers and other chemical residues. Results of these activities have been the essential disinfection of supplies and the consequent deterioration of the taste and odour of water, coupled with rising concern over the presence of minute quantities of pesticides, herbicides and other biologically active chemicals in public water supplies.

It is an interesting observation on the human condition that water in a bottle is perceived to be of higher quality than that from a tap. As the reader will see in due course, this is almost certainly true for the highest standard of bottled waters (Natural Mineral Waters). It is much less certain for other waters in containers.

The second chapter of the book provides data showing the variation in bottled water consumption in different parts of the world and the increasing bottled water consumption in the United Kingdom.

1.2. Product types

Bottled water categories are described in considerable detail in chapter 3. The brief summary below serves simply to introduce the reader to the subject.

There are two main styles of bottled water: sparkling and still. Sparkling water, usually rendered thus by the dissolution in it of carbon dioxide gas, though it may be naturally carbonated from some sources, is frequently consumed as a beverage in its own right, whereas still water (i.e. non-carbonated) is used as a drinking water.

Irrespective of whether or not products are carbonated, the water present can be further classified into one of the following categories:

- table (or purified) waters
- spring waters
- Natural Mineral Water
- flavoured waters
- mineral waters

1.2.1 *Table or purified waters*

This category of water is likely to be the least controlled in terms of its quality. In many countries there is nothing to stop unscrupulous individuals from bottling almost any quality of water and selling it to the unwary. In the United Kingdom, all bottled water other than Natural Mineral Water must at least meet the requirements of the Drinking Water in Containers Regulations 1994, which guarantee the suitability of the water for human consumption.

1.2.2 *Spring waters*

The description 'Spring Waters' is applied to a wide variety of waters. Usually there is no relevant legal definition and it is generally accepted that spring waters may be drawn from any source and the water may be processed before bottling. Some countries have a code of practice or similar agreement on what may constitute water of this description. In the United Kingdom, for example, the trade body to which most water bottlers belong (The British Soft Drinks Association, BSDA) has an agreement with its members that a particular designation of Spring Water shall apply only to water from a single underground supply.

1.2.3 Natural Mineral Waters

In many parts of the world, the European Community (EC) in particular, this is a reserved description, supported by legal statute, for the highest quality of groundwater supply.

To meet the standard for Natural Mineral Water in the EC, a water must meet the following criteria.

- It must originate from a specified underground source protected from any kind of pollution.
- It must be of stable chemical and physical composition.
- It must meet stringent microbiological criteria; in particular, freedom from harmful bacteria and parasites.
- It must receive no treatment other than filtration (provided this does not alter the water's composition in any way or its microbiological status from source), carbonation or by the addition of carbon dioxide.
- It must be bottled at source.
- It must be registered with the appropriate authority (this process requires an extended period of prior testing—two years in the United Kingdom).
- It must undergo regular testing in an approved laboratory to ensure continued maintenance of quality criteria.
- It must be appropriately labelled with a declaration of an official analysis and it must show the source of the water, its registered name and the country of origin.

There has been considerable debate about whether a Natural Mineral Water in the EC may or must be able to demonstrate health benefits. At the time of writing, it seems likely that 'may' rather than 'must' is likely to be confirmed.

1.2.4 Flavoured waters

A range of products has been developed in which flavourings and or small quantities of fruit juices are added to water. Most authorities appear to take the view that such products cease to be 'water' and fall within the category of soft drinks. This is especially so when sweeteners and small quantities of acids and other ingredients are also used. Flavoured waters and clear soft drinks as such fall outside the scope of this book.

1.2.5 Mineral waters

The term 'mineral water' may have different meanings. For example, in past years carbonated soft drinks (and in particular uncoloured lemonade) in the United Kingdom were referred to as mineral waters or 'minerals'. However, mineral water is more likely to refer to water containing significant quantities of dissolved minerals (mineral salts). Such waters may fall outside the general