Second edition

INDUSTRIAL CHOCOLATE MANUFACTURE AND USE

Edited by S. T. Beckett

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Edited by

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Industrial Chocolate Manufacture and Use

Preface

This second edition of *Industrial Chocolate Manufacture and Use* has been produced five years after the first. While it was very gratifying to be asked to revise it, several problems arose. One of the most important was in deciding what to add and what to remove. A survey found that microbiology was regarded as important, and concepts like HACCP and ISO 2000 appeared to be very relevant. With this in mind a new chapter on microbiology has been added, and I am very grateful to Dr Mazigh from Barry in France for writing it. Not only is he a recognized expert in the field but he adds to the multi-national authorship, which was one of the principles behind the book.

Another problem was the lack of information on physical constants, such as density and specific heat, for chocolate, cocoa liquor and cocoa butter. Although these values exist they are often hard to find. A table of some of these has therefore been included which I hope will prove to be of use. The source of the information has also been given as other values can also be found in the literature.

A certain amount of reordering has been carried out and the emphasis changed where it was thought to be becoming more important, as, for instance, with the likely increased use of vegetable fats in Europe. Some repetition is unavoidable in a multi-author book, and indeed some seeming contradictions are present. These are deliberately left as each author has written according to his or her own experience.

It is hoped that the book continues to provide an up-to-date scientific and technical approach to the principles of chocolate manufacture, from the growing of the cocoa beans to the packaging and marketing of the final product. As the processes become larger and more complex, the aim is to give the reader the principles behind them in a practical and readable form.

Once again I would like to thank the authors who have contributed to the book for the care they have taken and the time spent in producing their chapters. Even revising an original chapter can take a considerable effort in confirming new information, updating references, etc. There are four new authors, three from large international companies not previously represented and from three different countries. I am sure that this will add to the width of knowledge and experience found in the book. I would also like to thank Nestlé for their help and permission to carry out this revision, my family for their help and for putting up with me spending most of my free time on it, and Blackie Academic and Professional for giving me the opportunity to carry it out.

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Contributors

Stephen T. Beckett, BSc (Durham), D.Phil. (York, UK) in physics, worked for 8 years on research into asbestosis. The interest gained here in particle size distribution measurement, together with its effect on flow properties, has continued into the confectionery industry. Here he has worked for over 14 years, initially for Rowntree Mackintosh and subsequently with Nestlé. The work has primarily been concerned with research and development, but also included a period as Process Development Manager. He has given several lectures on different aspects of chocolate making at Leatherhead in the UK and Solingen in Germany, as well as one presentation at the PMCA conference in the USA, and written several published papers on these topics.

B.L. Hancock qualified in 1941 with a first class honours degree in Botany. He was involved in research into cocoa growing in Trinidad and Ghana before joining Rowntree's Research Department in 1945. Here he was Divisional Research Manager concerned with all aspects of usage of cocoa beans when he retired in 1981. He continued acting as a consultant on cocoa until his death in 1992.

Mark Fowler obtained a BA in Zoology from the University of Oxford. He joined Rowntree in 1977 and spent several years forecasting the size of the West African cocoa crop. He also participated in a cocoa quality improvement project working with cocoa farmers in Cote d'Ivoire. After a period spent in technical management in confectionery factories, he joined, in 1991, Nestlé's research and development centre at York in UK. He is currently responsible for the Cocoa, Chocolate and Process Development sections. He is a member of the UK Biscuit, Cake, Chocolate and Confectionery Alliance's Cocoa Research Sub-Committee which supports research into various aspects of cocoa growing.

Christof Krüger studied chemistry and sugar technology at the Braunschweig Institute of Technology. After his graduation as 'Diplom-Chemiker' (M.Sc.), he worked in German sugar companies and was the first applications manager in the German sugar industry. Concurrently with this function he was also senior manager of a company producing caramel colours and sugar syrups and was involved in the commercial and technical planning of a new liquid sugar plant. For seven years, he was chief chemist at Rowntree Mackintosh, Hamburg, where his responsibilities included management of the laboratories, quality control, product development and the sensorics department. He also worked actively on the committee for food law and on the scientific committee of the Association of the German Confectionery and Chocolate Industry, by which association he was commissioned to serve as research representative on the confectionery section.

Since 1986, Christof Krüger has been technical applications manager at Finnsugar Xyrofin, Hamburg. In this capacity, he advises customers in the food industry, and especially in the confectionery and chocolate industry, in the use of various bulk sweeteners. He frequently presents papers and acts as moderator at international symposia at the Central College of the German Confectionery Trade at Solingen.

Dr E.H. Reimerdes has a Ph.D in Pharmaceutic Food Sciences and was head of the Department of Food Chemistry and Technology at the Bergische University, Wuppertal, and Dean of the Faculty of Chemistry and Biology. He is also a corresponding member of the Academie Nationale de Pharmacie and a member of many national and international organizations. Subsequently he worked for Meggle before being appointed as head of Research and Development for the Food Division of Nestlé in Switzerland in 1992.

Dr Hans-A. Mehrens has a Ph.D. in human nutrition and food science and was a member of the faculty in the Department of Food Chemistry and Technology at the Bergische University,

Wuppertal. His main research interests were functional properties of food proteins, protein modification and nutritional aspects of protein utilization. In 1988 he joined Meggle where he is currently head of research and development.

Dr J. Kleinert has for many years been one of the foremost figures in European chocolate making. Following military service he obtained a degree in food engineering followed by a Dr. sc. techn. at the Swiss Federal University, ETHZ, in Zurich. He started to work for Lindt & Sprüngli Ltd in 1951, and was their laboratory manager for R&D until his retirement in February 1987. In 1970 he was appointed a Vice-Director of the company. A prolific writer, he has over 66 published papers on chocolate-related subjects as well as five published patents. He has been a frequent lecturer at the Fraunhofer-Institut in Munich, the German Confectionery School in Solingen and the ETHZ in Zurich. In North America he gave presentations at the PMCA Conferences in 1961, 1966 and 1971 and at the University of Guelph in 1974. As well as acting as a consultant on numerous occasions, he was a member of the Commission of Experts of Office International de Cacao et du Chocolat, President of the Commission of Chemists of Chocosuisse, President of the Research Group of the Food Branch Association, and a member of the Swiss Federal Commission to Promote the Scientific and Applied Research (Swiss Nationalfonds) and the commission to revise and update the Swiss Food and Drug Handbook.

Dr. E.H. Meursing studied chemistry and microbiology at the University of Amsterdam. He has worked for over 30 years in the field of cocoa, as head of the laboratory of Cacoa de Zaan, president of the Analytical Committee of the OICCC and author. Currently he is actively involved in the SGS Cocoa Bean Collection and Data Bank, which he founded 6 years ago.

Dr E.-A. Niediek is one of Europe's best-known authorities on chocolate manufacture. After studying machine building and chemical engineering he worked under Professor Rumpf at the University of Karlsruhe. His thesis in 1968 was concerned with the improvement of chocolate processing. He was a member of the Food Technology Department of the University of Karlsruhe from 1964 to 1985. Since 1983 he has been a lecturer in Food Technology at the Technological University of Hamburg-Harburg and in 1985 was appointed Director of the Deutsches Institut für Lebensmitteltechnik, an institute carrying out research for the food and confectionery industries.

Dr Paul S. Dimick is a Professor of Food Science at The Pennsylvania State University and has been involved in chocolate research for 20 years. He has had over 170 scientific papers and abstracts published with emphasis in chocolate and dairy flavour chemistry and processing technology, and cocoa butter crystallization behaviour. He has advised 32 advanced degree candidates and teaches Food Chemistry, Cacao Science and Technology, and an annual short course for industry personnel on Chocolate Manufacture. His research has been supported by the Pennsylvania Manufacturing Confectioners' Association, Chocolate Manufacturers' Association of the US, and the National Confectioners' Association of the US.

Dr Jonathan Hoskin has coauthored with Professor Dimick several scientific review papers on non-enzymatic browning during processing of chocolate. While at Clemson University, where his main interest included chocolate flavour chemistry, flavour chemistry of dairy products, dairy processing and food and light interactions, he published over 15 technical publications. He currently is programmer analyst at the division of Computer Information Technology, Clemson University.

Dieter Ley, Dipl.-Ing., worked for the chocolate and confectionery firm of Messrs Sprengel, Hannover, from 1964–79, initially as manager of technical planning of the chocolate factory and eventually as General Technical Manager. From 1979 until 1988 he was Technical Director of Messrs Frisse, Herford. He represented them at the Pennsylvania Manufacturing Confectioners' Association and at the study group for chocolate at the Fraunhofer Institute for Food Technology and Packing in Munich. A frequent lecturer, his venues have included Solingen (Germany), PMCA, Japan and China. In addition he is a member of the European Candy Kettle Club, and on the working committees for machines and plants in the confectionery industry and the VDI Commission Air Purity Preservation and Emmision Reduction in the chocolate industry.

Dr J. Chevalley studied at Lille where she obtained a degree in chemical engineering. Having obtained a doctorate in physical chemistry in Paris, she joined the Nestlé Company in 1963. Her work has been primarily concerned with the rheology of chocolate, and she published a review of this topic in *Journal of Textural Studies* in 1975, and on a new model for chocolate viscocity in the same journal in 1991. She is currently a member of the OICCC working group on the Rheology of Chocolate.

Geoff Talbot (B.Sc, MRSC, C. Chem.) joined Unilever Research from the University of Manchester Institute of Science and Technology. During almost twenty years with Unilever Research in Welwyn and Culworth House, he studied the use of speciality fats in confectionery applications. Much of this was directed at the use of cocoa butter equivalents and encompassed novel processes in the production of CBEs, the optimisation of the composition of CBEs using both mathematical and physical methods of analysis, and the application of CBEs and their use to optimise both the processing and sensory characteristics of chocolate. During this period he also studied the phenomena of fat migration and moisture migration in confectionery products and has been the author of several papers and also lectured on these topics. Six years ago he moved to Loders Croklaan, Ltd, as Senior Applications and Technical Services Manager for the UK.

Roy Nelson has had almost 40 years in the confectionery industry, starting as a confectionery machinery designer, then nine years with Baker Perkins as a design engineer. He presented a paper to the 21st PMCA Production Conference in 1967 on Tempering and Enrobing. He joined John Mackintosh & Son Ltd in 1968 as Research Manager, and after six years moved to Tourell for 18 months, developing raw ideas in gas cooking and systems designs. He has been with Rowntree Mackintosh and subsequently Nestlé for 17 years as chief designer and CAD manager, using computer and state-of-the-art developments.

Ken Jackson has his City and Guilds qualification in Chocolate Sugar Confectionery and has over 37 years experience in the Candy Industry with Rowntree Mackintosh (Nestlé) in the UK, Canada and more recently in the USA. He has worked in new product development research, production, technical services and packaging development, in all aspects of chocolate making and confectionery including high boils creams, jellies and caramels. Whilst in Canada he helped organize and then taught an industrial candy making course for 17 years. He is currently Process Applications Manager for Westreco, Inc. (Nestlé) in Fulton, New York, USA.

Ian McFarlane (M.A. Ph.D. in applied physics) has 25 years' experience of process instrumentation. From 1972 to 1982 he worked for United Biscuits, where he was Manager of Process Control Development. Until 1992 he was Director of the Beaconsfield Instrument Company, which he founded on leaving United Biscuits. He is author of *Automatic Control of Food Manufacturing Processes*, published by Applied Science Publishers (1983).

Dr Daniel A. Mazigh (D.Sc.) has 13 years' experience in medical research at the Institute Pasteur, Paris, where his work was concerned with the genetics of the virulence of *Yersiniae*. Since 1990, he has been the Group Scientific director of Barry, and also been in charge of the post-graduate course of medical bacteriology at the Institut Pasteur, Paris.

Norman Ferguson trained as a chemist and **Vince Martin** as an economist and their chapter draws on over 60 years of packaging experience from two contrasted yet complementary viewpoints. Both authors have been members of various industry committees, judging panels, etc. Both currently work for Nestlé, respectively in an operating company and in a confectionery research centre.

Colin Nuttall, by profession a statistician, worked for Mars Confectionery from 1945 to 1982 retiring as Corporate Planning Manager and Secretary to the Board of Management. He was Chairman of the Statistics Committee of the Cocoa, Chocolate and Confectionery Alliance, and for ten years the first President of the Joint International Statistics Committee for the ISCMA and the International Office of Cocoa and Chocolate, which awarded him their Gold Medal in 1982. He was a founder member of the Henley Centre for Forecasting, and remained on the Management Council until his death in 1990.

Wendy Hart graduated from the University of Reading (National College of Food Technology) in 1975 with a BSc. Hons in Food Technology and has worked at Cadbury Ltd for the last 17 years. She is involved in advising the company on Food Legislation and sits on several committees of the UK Trade Association (the BCCCA) including Health and Nutrition, Legislation and the Additives Working Party.

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