## HANDBOOK OF ALCOHOLIC BEVERAGES SERIES



## BCCI A Quality Perspective

Volume Editor

**Charles W. Bamforth** 



Series editors		vii
Lis	List of contributors	
Pr	Preface	
1	Beer foam: achieving a suitable head	1
	D. Evan Evans and Charles W. Bamforth	
	Introduction	1
	Beer foam physics	3
	Foam measurement	8
	Beer components that influence foam quality	12
	Proteins	13
	Non-starch polysaccharides	21
	Hop acids	22
	Cations	25
	Lipids	25
	Other foam negative/positive beer constituents	26
	Manipulating the brewing process to optimize foam quality	28
	Summary	48
	Acknowledgments	48
	References	48
2	Beer flavor	61
	Paul Hughes	
	Introduction	61
	The flavor unit	61
	Brewing raw materials and beer flavor	62
	Impact of beer production processes	72
	In-pack flavor changes	78
	Taints and off-flavors	80
	Holistic flavor perception	81
	Summary	82
	References	82

3	The flavor instability of beer	85
	Charles W. Bamforth and Aldo Lentini	
	Factors impacting the shelf life of beer	88
	The impact of temperature	95
	The chemistry of flavor change in beer	96
	An evaluation of processes from barley to beer in the context	
	of flavor instability	100
	References	105
4	Colloidal stability of beer	111
	Kenneth A. Leiper and Michaela Miedl	
	Summary	111
	Biological stability	112
	Importance of whole process to ensure stability	112
	Chill haze	114
	Protein in beer	114
	Beer polypeptides and their functions	116
	Identifying polypeptides by size	117
	Identifying polypeptides by amino acid composition	125
	Identifying polypeptides by hydrophobicity	130
	Summary of polypeptides	132
	Polyphenols	134
	Methods of detecting polyphenols	135
	Polyphenols in beer	135
	Haze-forming reactions between polypeptides and polyphenols	138
	Stabilization treatments	140
	Combined stabilization system (CSS)	150
	Other treatments	150
	Other non-biological hazes	151
	Testing the effectiveness of beer stabilization	152
	Haze identification	154
	References	154
5	Microbiological stability of beer	163
	Anne E. Hill	1.0
	Overview of microbial spoilage	163
	Outline of the brewing process	164
	Raw materials	165
	Wort	169
	Fermentation	169
	Storage and finishing	170
	Packaging and packaged beer	170
	Dispense	171
	Detection Improving migraphials gigal stability	171
	Improving microbiological stability	178
	Quality control	180
	References	181

6	Beer gushing	185
	Leif-Alexander Garbe, Paul Schwarz and Alexander Ehmer	
	Introduction	185
	Terminology	186
	Physical background of gushing	187
	Primary gushing	188
	Secondary gushing	201
	Summary	204
	References	205
7	Beer color	213
	Thomas H. Shellhammer	
	Color perception	213
	Measuring color	214
	Standard methods for measuring beer color	218
	Origins of beer color	221
	References	226
8	Beer and health	229
	Charles W. Bamforth	
	Atherosclerosis	232
	Hypertension and stroke	235
	The digestive system	235
	The reproductive system	237
	Brain and cognitive function	237
	Kidney and urinary tract	239
	Age	239
	Cancer	240
	Allergy	241
	References	242
A	ppendix Practicalities of achieving quality	255
	Charles W. Bamforth	
	Definitions of quality	255
	Responsibility for quality	256
	Quality systems	256
	Quality assurance versus quality control	257
	Specifications	258
	The cost of quality	258
	Statistical process control	259
	Process capability	261
	Control charts	261
	Standard methods of analysis	262
	Setting specifications and monitoring performance	270
	Hazard analysis critical control points (HACCP)	271
In	dex	279