

CONTENTS

	Page
1. The chemistry of rancidity in foods	1
1.1 Introduction	1
1.2 Rancidity	2
1.3 Hydroperoxide formation	8
1.4 Secondary reaction products	15
1.5 Hydrolytic rancidity	17
1.6 Antioxidants	18
References	21
Further reading	21
2. Measurement of rancidity	22
2.1 Introduction	22
2.2 Measurement of hydrolytic rancidity	23
2.3 Measurement of ketonic rancidity	26
2.4 Measurement of oxidative rancidity	26
2.5 Measurement of resistance to oxidative rancidity	37
Acknowledgements	50
References	51
3. Evaluation of oxidative rancidity	54
3.1 Introduction	54
3.2 Sensory evaluation of rancidity	55
3.3 Estimation of oxidation artefacts	56
3.4 measurement of induction periods	57
3.5 Changes in iodine value or in component fatty acids	60
3.6 Peroxide values	60
3.7 Newer methods based on oxidation intermediates	61
3.8 Methods based on physical measurements	62
3.9 Correlations between methods for evaluating rancidity	63
3.10 Accelerated test strategy	64
3.11 Conclusions	65
References	65
Further reading	67
4. Practical measures to minimise rancidity in processing and storage	68
4.1 Introduction	68
4.2 Design factors	69
4.3 Operational factors	76
Acknowledgements	82
References	82
5. The use of antioxidants	84
5.1 Basic principles and definitions	84
5.2 Why use an antioxidant?	85
5.3 Requirements of an ideal antioxidant	85
5.4 Oxidation of lard	86
5.5 Synergism	89
5.6 Popular misconceptions	90
5.7 Properties of the common antioxidants	90
5.8 Carry-through	97
5.9 Practical aspects of using antioxidants	99

5.10	Typical applications of antioxidants	100
5.11	Permitted rates of use	101
5.12	The future	101
	Acknowledgement	103
	References	103
6.	Spectrophotometric and chromatographic assays	104
6.1	Introduction	104
6.2	Substrate	105
6.3	Radicals	106
6.4	Hydroperoxides	106
6.5	Secondary decomposition products	117
6.6	Fluorescent products	124
	References	126
7.	Nutritional aspects of rancidity	128
7.1	Introduction	128
7.2	Toxic components	128
7.3	Dietary sources of oxidised fats	129
7.4	Food processes that lead to the oxidation of fats	132
7.5	Biochemical effects resulting from lipid peroxides	134
7.6	Acute effects	134
7.7	Chronic effects	135
7.8	Toxicological studies on thermally oxidised fats	136
7.9	Possible long-term effects associated with the consumption of oxidised fats	137
7.10	Conclusion	139
	References	139
8.	Rancidity in cereal products	141
8.1	Introduction	141
8.2	Hydrolytic rancidity	142
8.3	Oxidative rancidity	148
8.4	Factors affecting rancidity in cereal products	153
8.5	Conclusions	155
	References	156
	Further reading	156
	Appendix 1 : measurement of wheat bran lipase activity in flour milling products	156
	Appendix 2 : determination of degree of deterioration of flour milling products	157
	Appendix 3 : assay for lipoxygenase activity in cereal extracts	158
9.	Prevention of rancidity in confectionery and biscuits – a hazard analysis critical control point (HACCP) approach	160
9.1	Introduction	160
9.2	Ingredients	161
9.3	Packaging materials	163
9.4	Equipment	164
9.5	Processing	164
9.6	Shelf life	165
9.7	HACCP	167
9.8	Conclusions	176
	References	177
	Further reading	177
	Appendix	177
10.	Rancidity in dairy products	179
10.1	Introduction	179
10.2	Lipolytic rancidity	179
10.3	Oxidative rancidity	184
	Acknowledgements	188
	References	89

Further reading	189
11. Rancidity in meats	191
11.1 Introduction	191
11.2 Features special to meat	191
11.3 Types of rancidity	192
11.4 Special factors in meat which affect oxidative rancidity	194
11.5 Rancidity and meat flavour	198
11.6 Control of rancidity	199
References	201
12. Legislation and labelling	203
12.1 Introduction	203
12.2 Principles of food legislation	203
12.3 Hygiene	205
12.4 Irradiation	208
12.5 Rackaging	209
12.6 Contaminants	209
12.7 Additives	209
12.8 Labelling and presentation	217
References	220
13. Rancidity in creams and desserts	222
13.1 Introduction	222
13.2 Liquid creams	222
13.3 Solid creams	226
13.4 Powders	227
13.5 Conclusions	228
References	229
14. The control of rancidity in confectionery products	230
14.1 Introduction	230
14.2 The role of major ingredients	231
14.3 The influence of water activity on flavour stability	237
14.4 Individual confectionery fats	241
14.5 Nuts and seeds	248
14.6 Other factors	254
Acknowledgement	254
References	254
15. Rancidity in fish	256
15.1 Introduction	256
15.2 Mechanisms	257
15.3 Non-enzymic initiation	258
15.4 Enzyme initiation	260
15.5 Microsomal enzyme lipid oxidation	260
15.6 True enzyme initiation	261
15.7 Measurements	265
15.8 Control of rancidity in fish	267
15.9 Conclusions	270
References	270
Index	273