

## CONTENTS

|  | Page no. |
|--|----------|
| INTRODUCTION - THE CONCEPT OF WATER ACTIVITY AND ITS SIGNIFICANCE IN FOODS | 1        |
| 1.1 Introduction   | 1        |
| 1.2 Historical background  | 1        |
| 1.3 Definitions  | 1        |
| 1.4 Water activity and bacterial growth                                    | 5        |
| 1.5 Water activity and product quality                                     | 7        |
| 1.6 Water activity and its interaction with other preservative factors     | 8        |
| 1.7 Summary of the principal uses of water activity data                   | 9        |
| <br>   |          |
| 2. METHODS OF SAMPLING AND SAMPLE PREPARATION                              | 10       |
| 2.1 Introduction   | 10       |
| 2.2 Considerations   | 10       |
| 2.2.1 Obtaining the food sample  | 10       |
| 2.2.2 Preparation of test portion  | 10       |
| 2.2.3 Sample container ("pot")   | 12       |
| 2.2.4 Foodstuffs requiring special considerations                          | 12       |
| 2.3 Developmental and routine water activity measurements                  | 16       |
| 2.4 Packaging films  | 17       |
| <br>   |          |
| 3. PRINCIPLES AND METHODS OF WATER ACTIVITY MEASURING DEVICES              | 18       |
| 3.1 General Overview   | 18       |
| 3.1.1 The effects of sample temperature on measurement                     | 19       |
| 3.1.2 Uncertainty of measurements  | 19       |
| 3.2 Commonly used measuring techniques                                     | 20       |
| 3.2.1 Condensation (chilled mirror) hygrometer                             | 20       |
| 3.2.2 Electrolytic impedance hygrometer                                    | 20       |
| 3.2.3 Capacitive polymer hygrometer  | 23       |
| 3.2.4 Instrument configurations: electrolytic and capacitive hygrometer    | 25       |
| 3.2.5 Other methods  | 26       |

|       |   |    |
|-------|---|----|
| 3.3   | Maintenance and calibration of water activity instruments       | 28 |
| 3.3.1 | Maintenance   | 29 |
| 3.3.2 | Calibration   | 30 |
| 4.    | MICROBIOLOGICAL INTERPRETATION OF WATER ACTIVITY MEASUREMENTS   | 32 |
| 4.1   | Introduction  | 32 |
| 4.2   | Effects that interact with water activity                       | 32 |
| 4.2.1 | Solute  | 32 |
| 4.2.2 | pH, preservative and nutrient levels                            | 32 |
| 4.2.3 | Redox potential and partial pressure of gas                     | 33 |
| 4.2.4 | Method of food manufacture                                      | 33 |
| 4.2.5 | Storage times   | 33 |
| 4.2.6 | Temperature   | 33 |
| 4.3   | Water activity considerations with some types of product        | 34 |
| 4.3.1 | Emulsions   | 34 |
| 4.3.2 | Multi-layer products  | 34 |
| 4.4   | Effects of water activity on different groups of microorganisms | 35 |
| 4.4.1 | Gram negative bacteria  | 35 |
| 4.4.2 | Gram positive bacteria (non spore-forming bacteria)             | 35 |
| 4.4.3 | Gram positive spore-forming bacteria                            | 36 |
| 4.4.4 | Yeasts and moulds   | 36 |
|       | SUPPLIERS OF EQUIPMENT  | 39 |
|       | REFERENCES  | 40 |
|       | GLOSSARY OF TERMS   | 43 |