

# Particle Size Analysis

Proceedings of a Conference organized by  
The Analytical Division of the Chemical Society  
and held at the University of Salford  
12-15 September, 1977



Edited by

**M. J. Groves**

Department of Pharmacy  
Chelsea College, London

*Gro 11*

**HEYDEN**

London · Philadelphia · Rheine

*10898- PC 2*  
Inventar Nr. PC II / 617

# Contents

Foreword . . . . .	xi
--------------------	----

## MICROSCOPY

PLENARY LECTURE: Particle Size Measurement in the Sub-micron Range with Particular Reference to Pigments . W. CARR	3
'Difficult' Particulates—the Application of Microscopy and other Techniques . . . . . R. W. PERRY, J. E. C. HARRIS and H. J. SCULLION	18
Particle Size Analysis of Multicomponent Toner Systems . . . . . D. F. ALLIET, T. A. TIETJEN and D. H. WOOD	31
Validity of Determining Bacterial Size Distribution by Electron Microscopy . . . . . J. MURRAY and D. W. L. HUKINS	44
A Practical Approach to Reliable Quantitative Image Analysis of Carbon Black Electron Micrographs . . . . . E. REDMAN, F. A. HECKMAN and J. E. CONNOLLY	51
Measurement of Particle Sizes in Sprays by the Automated Analysis of Spark Photographs . . . . . A. J. YULE, N. A. CHIGIER and N. W. COX	61

## CALIBRATION MATERIALS AND SHAPE ANALYSIS

PLENARY LECTURE: Particle Size Characterization—A Review of Recent Technology . . . . . CLYDE ORR JNR	77
Some Current Work on Particulate Reference Materials R. WILSON	101

Shape Analysis of Particle Profiles Using the Fourier Transform. A. G. NAYLOR and C. D. WRIGHT	110
Cauchy's Projection Formula as a Basis for the Method of Determining Surface Area of Convex Bodies. J. BODZIONY and W. KRAJ	120
Variance Analysis of Particle Size Distribution Data by a Nested Linear Model M. W. G. BURT and W. I. R. MARTIN	131

### LIGHT SCATTERING

Transient Electric Birefringence for Evaluating the Size Distribution of Colloids in Suspension A. R. FOWERAKER, V. J. MORRIS and B. R. JENNINGS	147
The Particle Size of Inorganic Sols in Surfactant Solutions R. DESPOTOVIĆ	155
A Rapid Method for the Measurement of the Average Particle Size of Non-Uniform Lattices and Dispersions G. C. N. CHEESMAN	160
An Automatic Laser Light-Scattering Apparatus for Sub-micrometre Particles L. R. MOSLEY, J. H. NOBBS and D. PATTERSON	167
Laser Doppler Techniques in Aerosol Size Analysis J. I. T. STENHOUSE, B. SCARLETT and I. SINCLAIR	177
Application of Photosedimentation to the Measurement of Particle Size Distribution in Dilute Water/Oil Emulsions. J. LACHAISE, A. MARTINEZ and A. GRACIAA	187
Droplet Size Distributions from an Agricultural Spray Using In-line Holography P. DUNN and J. M. WALLS	196

### SIEVING AND AUTOMATIC METHODS

PLENARY LECTURE: Sieve Analysis: the Cinderella of Particle Size Analysis Methods? K. LESCHONSKI	205
---	-----

A Comparison of Sizing of Products by Sieving and by Coulter Counter in Copper Ore Processing H. LAAPAS and K. HEISKANEN	218
A New On-line Particle Size Analyser. K. LESCHONSKI, K. L. METZGER and U. SCHINDLER	227
Review: Recent Progress in Rapid Response and On-line Methods for Particle Size Analysis R. DAVIES and H. E. TURNER	238
Characterization of the Surface Area of a Fine-Particle Profile by its Fractal Dimension B. H. KAYE	250

### SURFACE AREA

A New Rapid Surface Area Diffusion Meter T. ALLEN	263
The Variation of Intra- and Inter-Particle Porosity with Degree of Compaction N. G. STANLEY-WOOD	278
Determination of the Mean Pore Size of Powder Compacts by Low Pressure Gas Permeability Measurements M. J. GROVES and M. H. ALKAN	289
Precautions in the Use of the Flow Microcalorimeter for Surface Area Measurements A. H. COLLINS, I. J. McEWEN and G. R. HEAL	298
The Krypton BET Method M. J. JAYCOCK	308

### COUNTING METHODS

Use of the HIAC PC 320 for Size Analysis of Transparent Polymer Beads L. S. GOLDEN	323
Use of a Modified HIAC Criterion PC-320 as an Airborne Particle Size Analyser. A. J. BEHRINGER, T. S. MIKA, D. H. WOOD and T. W. NASH	336
The Application of the Light Obscuration Principle to the Particle Size Analysis of Powdered Materials. G. C. WEST	347

Determination of Particle Size Distributions in Soils in Forensic Science and Assessment of their Similarity R. J. DUDLEY	356
Comparison of the Errors due to Sampling and to Analysis by Coulter Counter® P. J. LLOYD, J. I. T. STENHOUSE and R. E. BUXTON	367
Large Particle Measurement with the Coulter Counter® J. G. HARFIELD, B. MILLER, R. W. LINES and T. GODIN	378
The Particle Size Analysis of Multiple Emulsions (Water-in-Oil-in-Water) S. S. DAVIS and A. S. BURBAGE	395
Particle Sizing of Sephadex® in Quality Control by Using a Coulter Counter System and Computer Processing R. A. ANDERSSON	411

#### SEDIMENTATION

The Composition of Organic Pigment Particles and its Effect on Particle Size Analysis of Dispersions. R. B. McKAY	421
Concentration Effects in Particle Size Analysis by Sedimentation B. SCARLETT and S. K. COWLAM	430
Errors in Particle Size Measurement by Sedimentation L. SVAROVSKY and C. J. ALLEN	441
A New X-Ray Disc Centrifuge M. R. HORNBY and D. F. TUNSTALL	451
Theories of Hindered Sedimentation, and the Application of Interface Settling Rates to the Determination of Mean Particle Radii J. T. BHATTY, L. DAVIES and D. DOLLIMORE	458

#### POSTERS

Precision and Separation Effects of New Micro-Sieves E. HEIDENREICH	471
The Effect of Gum Tragacanth on Aggregation in Concentrated Aqueous Suspensions of China Clay J. T. BHATTY, D. DOLLIMORE and A. H. ZAHEDI	473

Size Distribution of Suspended Matter in the Water of the River Po near Piacenza . . . . .	474
A. BATTAGLIA, G. GHERSINI and L. QUAINI	
A New Data Reduction Unit for the Coulter Counter® . . . . .	475
S. KINSMAN, R. TALBERT and W. M. WOOD	
Radiometric Method for the Characterization of Particulate Processes in Colloidal Suspensions Systems . . . . .	476
BORIS SUBOTIĆ	

### APPENDIXES

Appendix 1: Manufacturers of Particle Sizing Equipment . . . . .	479
Appendix 2: List of Participants . . . . .	481
Index of Contributors . . . . .	487
Subject Index . . . . .	489