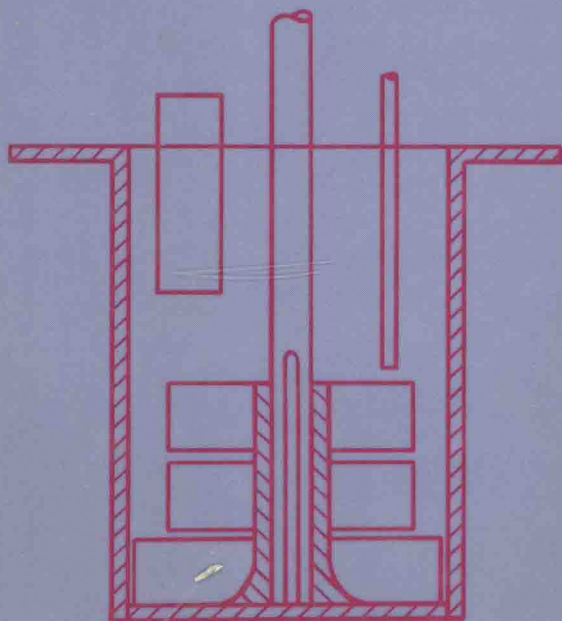


fertilizer science and technology series — volume 5

Manual of Fertilizer Processing



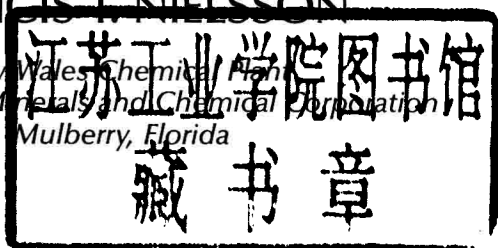
edited by
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Manual of Fertilizer Processing

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Manual of Fertilizer Processing

FERTILIZER SCIENCE AND TECHNOLOGY SERIES

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- Vol. 4. Nitric Acid and Fertilizer Nitrates, *edited by Cornelius Keleti*
- Vol. 5. Manual of Fertilizer Processing, *edited by Francis T. Nielsson*

Additional Volumes in Preparation

Foreword

It is a great pleasure for me to introduce this *Manual of Fertilizer Processing*, which is the fifth volume of the Fertilizer Science and Technology series. Francis (Frank) T. Nielsson, the editor of the book, my long-time friend and colleague, has over 40 years of experience in the fertilizer industry, ranging from ammonia manufacture to the extraction of uranium from phosphoric acid, but he is best known for his work with compound or "mixed" fertilizers—fertilizers that contain two or more of the primary plant nutrients: nitrogen, phosphorus, and potassium. Compound fertilizers also may contain one or more of the ten other elements that are essential to plant growth.

The farmers of most developed nations use compound fertilizers that are formulated to supply those elements that are not available in the soil in sufficient quantity to yield good crops. Although these farmers often started with a single nutrient fertilizer, which was most limiting, many of them are now turning to mixtures that supply their specific needs.

Compound fertilizers may be made in a variety of methods ranging from simple mixing to production in a large chemical plant. Eight of the chapters in Nielsson's book describe these different methods for preparing compound fertilizers. The remaining chapters concentrate on how some of the raw and intermediate materials are produced and used in the manufacture of compound fertilizers. (Manufacture of some of the intermediate materials, such as ammonia, nitric acid, ammonium nitrate, and phosphoric acid, has been described in previous volumes in the series.)

The objective of the fertilizer industry is to deliver to the farmers of the world the nutrients they need to produce crops that

are satisfactory in quantity and quality for their markets. Not only must the fertilizer products contain appropriate proportions of nutrient elements, they must also be delivered to the farmer in such physical form that he can apply them to the soil evenly or place them accurately. Since farmers' needs and their degree of mechanization vary widely, the finished product may vary widely in both chemical composition and physical form. In this book Mr. Nielsson has brought together accounts of some of the diverse methods for supplying these needs. His wide experience both in the United States and in many other countries qualifies him for this work.

Mr. Nielsson is a long-time member of the Board of Directors of the Fertilizer Industry Round Table and was chairman of that group in 1979 and 1980. He is also active in the American Chemical Society's Division of Fertilizer and Soil Chemistry, and in 1983 he received that Division's Award of Merit.

Travis P. Hignett

Preface

The purpose of this volume is to update the mixed fertilizer industry since the last book on the subject—*Chemistry and Technology of Fertilizers* by Vincent Sauchelli, published in 1960.

At the time of Sauchelli's publication, granulation was just becoming a major factor in fertilizer production. Wet-process acid and diammonium phosphate technology was in its infancy. Single superphosphate was the dominant phosphatic fertilizer, and triple superphosphate was beginning its role as a component of mixed fertilizers. Ammonia plants had multiplied during World War II to provide nitric acid for munition plants. Urea was an agricultural curiosity.

Not only has fertilizer technology become more complex since the time of Sauchelli, but there has been a change in direction in fertilizer raw materials. Today diammonium phosphate is the dominant phosphatic fertilizer. Single and triple superphosphate have become minor constituents in a fertilizer mixture, being replaced by wet-process acid, which is ammoniated in situ.

What used to be called "dry-mixing," preparing a mixture of powdered raw materials slightly ammoniated with aqua ammonia, has become a new branch of the industry called "bulk blending," utilizing granular raw materials.

Although significant changes have also occurred in fertilizer distribution and application, these are not covered here.

The purpose of this book, by updating technology since 1960, is to provide personnel associated with the fertilizer industry, in both the more and less developed countries, with information about mixed fertilizers that will have value in making administrative decisions as well as with ideas for debottlenecking and solving production problems.

In the United States, one rarely sees single-superphosphate or triple-superphosphate plants in operation. However, in less developed countries, these phosphatic materials continue as an important raw material in fertilizer mixtures. At the same time, the use of wet-process acid is becoming a major practice in less developed countries.

As one travels around the world, the technology of the old and the new is seen as a challenge to obtain the best variations in fertilizer technology. This book offers help in meeting the challenge.

Francis T. Nielsson

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