Removal of ammonium from aquatic environment using bentonite and its modified forms

by Aning Ayucitra

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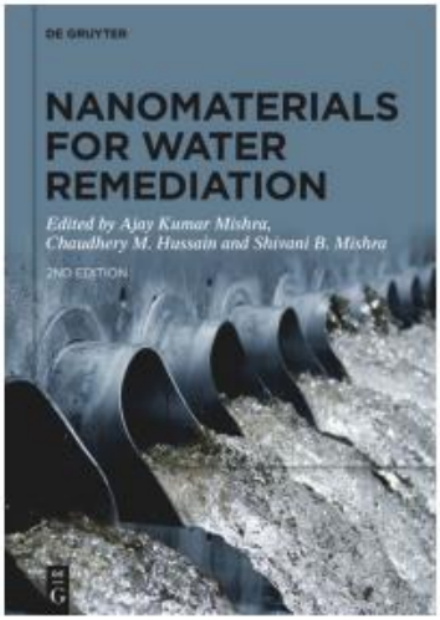

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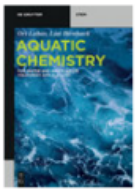

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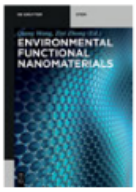

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Preface

Nanomaterials are being used to develop more cost-effective and high-performance water treatment systems. Nanomaterials in water research have been extensively utilized for treatment, remediation, and pollution prevention. Remediation is the process of removing toxic pollutants from water. This book entitled *Nanomaterials for Water Remediation* focuses on the carbon-based materials, nanoadsorbent metals, nanoparticles, cryogels, and bentonites for the remediation of various organic and inorganic pollutants from wastewater. Water pollution is mainly caused by pollutants, which lead to severe environmental and health problems. It is a well-established fact that carbon-based materials are very effective for the removal of both organic and inorganic pollutants from wastewater, and nanomaterials have better adsorption capacity, selectivity, and stability than the nanoparticles.

This book broadly covers the fundamental knowledge and recent advancements for the research and development in the field of nanotechnology, environmental science, and water research, which will be highly beneficial to graduate and postgraduate students. The book also provides a platform for all researchers as it covers a huge background for the recent literature and abbreviations.

Ajay Kumar Mishra, Chaudhery Mustansar Hussain, and Shivani Bhardwaj Mishra
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Felycia Edi Soetaredjo, Suryadi Ismadji, Yi-Hsu Ju,
and Aning Ayucitra

5 Removal of ammonium from aquatic environment using bentonite and its modified forms

5.1 Introduction

The presence of ammonia in an aquatic environment often creates serious problem to the aquatic ecosystem due to eutrophication process. The existence of this substance in certain amount in water environment can promote the excessive growth of algae and as a consequence reduce the concentration of dissolved oxygen in water [1]. Accumulation of ammonia in aquatic system occurs through various pathways such as natural byproducts of fish metabolism, microbial metabolism, agricultural operations, food processing industries, pulp and paper factories, fertilizer industries, and municipal wastewater discharge.

In aquaculture industry, one of the most important parameters of water quality is the ammonia content. This substance has a very bad impact to aquatic biota, especially fish and crustacean. At low concentration, ammonia can cause stress to fish and also damage gills and other fish tissues. Long-time exposure of low concentration ammonia to fish causes poor growth, and fish will be more susceptible to bacterial infections [2]. Reduced reproductive capacity and reduced growth of the young are other possible ecological impacts of the presence of ammonia in the aquatic environment.

In an aqueous system, ammonia exists in two different forms simultaneously. The unionized ammonia (NH_3) is more harmful to aquatic microorganisms than the ionized ammonia (NH_4^+). Both forms of ammonia usually are expressed as total ammonia nitrogen or TAN. Temperature and pH have significant influence on the forms of ammonia [2]. At high pH and temperature, the formation of NH_3 is more favored than that of NH_4^+. Even the proportion of NH_3 and NH_4^+ fluctuates with pH and temperature; however, the TAN in water may remain constant [3].

The presence of ammonia in aquatic system also has a critical role in the nitrogen cycle. In the water environment, this substance is usually rapidly transformed into other nitrogenous forms through several processes such as fixation, assimilation, ammonification, nitrification, and denitrification [3]. Among these processes,

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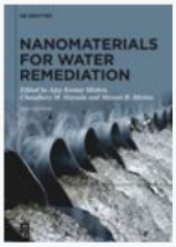

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