CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME I

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CHAPTER 22

ANALYSIS OF ELECTROFORCED SEDIMENTATION OF ZINC OXIDE

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ABSTRACT

This paper presents results of experimental work carried out to study the role of polyacrylamide as dewatering aid in electroforced sedimentation. Electroforced sedimentation experiments under constant electric current density of zinc oxide and kaolin suspended in aqueous media with and without polyacrylamide were carried out and comparison is made between the experimental results and model predictions. The model solution of basic differential equation was used to measure the progress of electroforced sedimentation, represented by an average consolidation ratio U_c as in mechanical expression. The addition of polyacrylamide as a dewatering aid enhanced the electroforced sedimentation.

Keywords: electroforced sedimentation, consolidation coefficient, electro-osmotic pressure

INTRODUCTION

In the process of sludge handling, disposal and re-use of biosolids is one of the most significant challenges in wastewater management. Dewatering by conventional belt press filters can achieve only small solids contents leading to high expenditure for the transport and disposal of these materials. Another option is the incineration of sludge. But since the water content of the sludge is usually very high, energy consumption is the major concern. That is, such sludge is usually highly compressible, and mechanical dewatering is impeded due to a very high hydrodynamic resistance of the sludge.

Application of electric field, to enhance the separation, is one of the techniques studied recently. Electrokinetic effects play a large role in such separations. In elecroforced sedimentation, the separation of liquid from a solid-liquid mixture is achieved between two electrodes. Its principal use would be in reducing water content in environmental sludge and biosolids, thereby reducing the volumes to be disposed through landfills, incineration, or other means. In electroforced sedimentation with moderate electric field strength, the moisture of a solid-liquid mixture remains unchanged at the surface of the sediment, while it decreases drastically near the bottom of the sedimentation column. This fact is widely known; to date however, due to paucity of analytical method, it has not been successfully explained. Previously, some works were done related with electroforced sedimentation (Shirato et al., 1979; Iwata and Yi, 1995; Iwata et al, 1991). In our previous report, the solution of the basic