EXPERIMENTAL EVIDENCE ON THE ROLE OF PHYSICO-CHEMICAL EFFECTS ON SETTLING AND RESUSPENSION OF COHESIVE SEDIMENT

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Abstract

The fine-grained fluid aggregates namely peloids can cause extensive deposition which affect the flow regime considerably. In coastal zones, it is necessary to prevent the erosion and the transportation of fine material, to immobilize or stabilize the local deposits. Furthmore, fine-grained sediments can be contaminated by heavy metals or some other pollutants.

The elimination of muddy sediments in river and lake waters can so far be processed only with mechanical evacuation methods under extreme energy expenditure. However even the most common method such as flushing jet is not enough for elimination of the consolidated sediments because the flushing jet cannot moves the sediments spaciously in the despite high shear stresses at the bed. Since further danger potentials in the port and in the power station intakes can be produced by the deposits at extreme discharges. Hence, water radiation and agitation with the addition of compressed air must be used.

The present work deals with the collection of the physico-chemical influences on the settling processes of the suspended fine particles and the effect of air addition on the mechanism of resuspension in settling column. The test equipment consisted of plexiglass with 100 cm height and inner edge lengths 14.1 cm, above the settling column a measuring tent is topped for the measurement of the settling concentration by CCD-Camera with long-wave light without disturbance. Furthermore, the diode laser measured the size of gas bubble. The experiment also consists essentially of two rays of a 1mW of diode laser in the distance of 2.0 mm in order to examine the resuspension of the deposited fine material under presence of gas bubbles.

In the first part of my research work, an investigation of the physico-chemical effects has been carried out under ion addition (*NaCl*) and varying pH value in still water since settling effects in nature arise particularly within the range of small flow velocities. The physico-chemical effects cause different processes and structures which arise from the structure formation of fine particles. These admirably stable structures affect the flow conditions. Suspension of different concentration possess different viscosities and surface tensions, which causes other transportation characteristics in near-bed layers than in the

free water body.

The second part of this work examines the resuspension of the fluid mud layer under presence of gas bubbles on the basis of the above-mentioned results. With regard to the erosion of the material, pressure pulses, which result from the turbulence of the flow also play a role apart from shearing stresses. The influence of turbulence and gas bubbles on the erosion of muddy sediments is so far insufficiently investigated. This study also wants to contribute to the clarification of this question.

Laboratory tests have confirmed the significant influence of increasing salinity which can lead to flocculation due to the intermolecular attraction and thus to settling of the particles. The vertical concentration profile of cohesive sediments was on the decrease because of the increasing salinity. The vertical concentration profile of alumina was on the decrease quicker than quartz with increasing salinity. Furthermore, the influence of the pH value on the settling behavior of alumina was confirmed. At a pH value of 4.2 low average settling verlocities were measured. At pH 8.9 high average settling verlocities of alumina were observed, which caused strong flocculation.

Furthermore, the bubbles enhanced the resuspension of the deposited fine material (Al_2O_3) at the flow bed. The amount of air and the velocity of gas were found as significant parameters. With increasing gas content alumina remained in suspension at high pH values in the laboratory test, where the particles fall more rapidly without air addition. The axial distribution of the resuspension led to a more homogeneous vertical profile.