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Abstract. Kapuas River is a river with a high level of sedimentation. In the process of sedimentation, one of the factors that determines the sedimentation time is the sediment settling velocity. Estimation of effective sediment deposition time could be calculated by collecting the sediment settling velocity data. A thorough laboratory research is needed to determine the value of sediment settling velocity. The analysis from the field and laboratory research showed that sediment settling velocity is related to salinity, sediment concentration, water depth, and flow velocity. This study focuses on the relationship between sediment concentration and sediment settling velocity. Laboratory research was conducted using variations of sediment concentration. The research showed that maximum sediment settling velocity with the value of 0.4133 mm/s is obtained from concentration sediment of 9380.75 ppm. Moreover, the sedimentation process will be formed faster as the sediment settling velocity increases.

1. Introduction

The Kapuas River is located on the province of West Kalimantan, Indonesia, as shown in Figure 1. Kapuas River is a river with a high level of sedimentation thus attracting researchers around the world to study its special feature. Several spots on the Kapuas River have experienced sedimentation. Sedimentation time is one of the factors affecting sedimentation process where estimation of effective deposition time can be calculated. Sediment settling velocity is influenced by several factors, one of which is the amount or concentration of sediment.

Figure 1. Kapuas River in West Kalimantan, Indonesia
(Source: www.freeworldmaps.net)

2. Literature

According to Pipkin (1977), sediments are materials or fragments of rock, minerals and organic material that are transferred from various land and sea water sources and deposited by air, wind, ice, and water. In addition, there are also those that can be deposited from materials that float in water (suspension) or in chemical form at a place (chemical precipitation).

Cohesive sediments are granules of mud particles usually found at the bottom or in a body of water which when joined together will form a larger unit called a floc. This process is very dependent on sediment concentration. Flocculation that occurs greatly affects the cohesive sediment settling velocity. The greater the concentration of flocculation that occurs, the greater the sediment settling velocity (Irham, 2000).

3. Methodology

Following are the steps carried out in the research:

1. Sampling to Kapuas River estuary
2. Preparing samples in the hydraulic lab
3. Determine the specific gravity and diameter of the samples
4. Experiment of sediment settling velocity using bottom withdrawal tube with 8 different types of sample concentrations. Illustration can be seen on Figure 2.
5. Analyze the data obtained and then drawing the conclusion

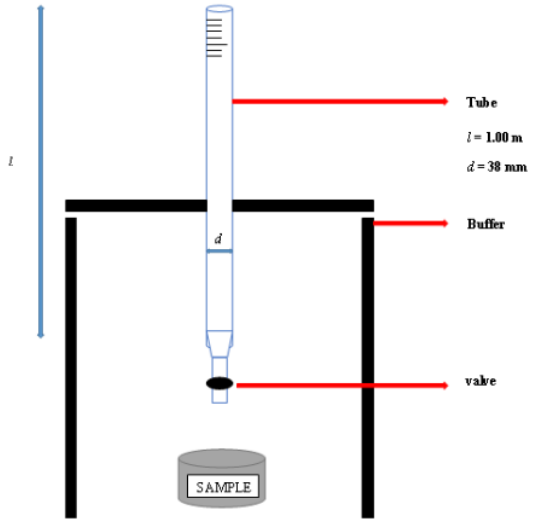

Figure 2. Bottom Withdrawal Tube Setting

4. Result and Discussions

This study using 8 types of samples with different sediment concentrations (in units of ppm). In this experiment, samples will be taken every 3, 6, 10, 20, 40, 60, 120 minutes. From this process, the cumulative settling velocity data will be obtained from each of the existing samples.

The settlement speed data from eight samples (E1, E2, E3, E4, E5, E6, E6, E7, and E8) can be seen in Table 1.

Table 1. Kapuas River Sediment Settling velocity

Sample Code	Settling velocity (mm/s)	Concentration (ppm)
E1	0.20	262.65
E1'	0.22	262.65
E1"	0.22	262.65
E2	0.25	468.50
E2'	0.25	468.50
E2"	0.25	468.50
E3	0.28	861.00
E3'	0.29	861.00
E3"	0.28	861.00
E4	0.28	3130.75
E4'	0.30	3130.75
E4"	0.29	3130.75
E5	0.32	4962.00
E5'	0.32	4962.00
E5"	0.33	4962.00
E6	0.43	9380.75
E6'	0.40	9380.75
E6"	0.41	9380.75
E7	0.37	14349.13
E7'	0.38	14349.13
E7"	0.36	14349.13
E8	0.35	16704.00
E8'	0.35	16704.00
E8"	0.35	16704.00

From Table 1, a graph of the settlement speed against the concentrations of each sample is plotted as seen in Figure 3. The graph shows that the concentration of sediment affects the speed of sediment settlement in a parabolic form. At a small concentration, the speed of settlement is small. Therefore, increasing sediment concentration will increase the sediment settling velocity. However, this nature is not continuous, when sediment is continuously added, it will reach its maximum limit thus causing the sediment settling velocity to decrease again. It can be seen from Figure 3 that the maximum settling velocity obtained is 0.4133 mm/s where the concentration is 9380.75 ppm.

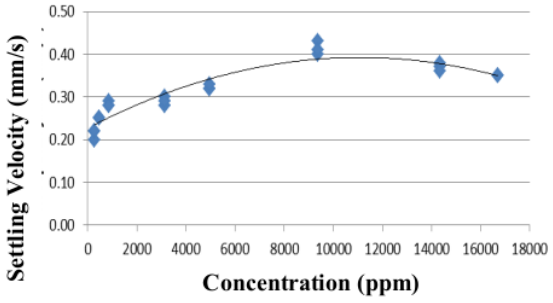

Figure 3. Graph concentration vs. settling velocity

5. Conclusion

The lowest sediment settling velocity occurred at a concentration of 262.5 ppm and the fastest sediment settling velocity at a concentration of 9380.75 ppm. If the sediment settlements slower, the sedimentation rate will be formed in a longer time, whereas the faster the sediment settlements, the sedimentation at the river bed will be formed quicker.

Concentration affects the speed of sediment settlements due to flocculation that occurred in the study. The lower the concentration, the slower the speed. While the higher the concentration, the faster the settlement speed, but only to a certain limit. After passing this limit of concentration, the sediment settling velocity will decrease even though the concentration increases.

Acknowledgements

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