Effect of types of control materials in a modified sedimentation equipment batch laboratory scale

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Abstract. The purpose of this research is to be able to recognize laboratory scale sedimentation devices in the process of deposition through batch system experiments in a cylindrical tub, to explain how the relationship between time, height of deposition and concentration of various solids with sedimentation rates, can compare the precipitating materials used in the sedimentation process both manually and automatically, and can determine the performance of tools and sedimentation rates by using a variety of sedimentation and flocculant materials used in the sedimentation process both without the addition of flocculants or with the addition of flocculants. In supporting this research, the method used is experimentation and analysis. The sample is a mixture of media that is water - depositional material (solids) where the depositional material has previously been sieved and cleaned of impurities and the variables analyzed were deposition time, deposition height, suspension concentration and concentration of flocculant addition. The settling material used varies, among others: 50 grams, 100 grams, 150 grams, 200 grams, and 250 grams, then put into a settling tube. While the results can be obtained from visualization data that is based on more accurate observations and data processing conditions (measurements) obtained in the form of the influence of time on settling rate, the influence of sedimentation column height on settling rate and the effect of solid concentration on settling rate. From the results obtained from various settling materials, the settling speed for CaCO₃ precipitates without flocculants and with flocculants is 4.43 cm / minute and 3.86 cm / minute. For the settling speed for tapioca flour depositor without flocculant and with flocculant is 23.64 cm / minute and 23.47 cm / minute. And for settling speed for dry soil sedimentation material without flocculant and with flocculant is 18.60 cm / minute and 15.10 cm / minute and for settling speed of active carbon precipitation material without flocculant and with flocculant is 7.76 cm / minute and 7.05 cm / minute.

1. Introduction
In everyday life sedimentation is used to reduce superimposed materials such as turbidity in water and also has a role to reduce the content of certain pathogenic organisms that are in water. In addition, this sedimentation operation is also used on an industrial scale to reduce pollution from industrial waste. In industry, sedimentation is carried out in a continuous (often) manner which is often called a thickener. And in the chemical industry it is also often necessary to separate the components of a mixture so that it is separated into their respective fractions. A component has different fractions in terms of particle size, phase or chemical composition. Sedimentation itself is a process of separating solids from liquids (solid-liquid) by using the force of gravity to settle suspension particles. This separation process is based on the movement of solid particles through the fluid due to the gavitation force [1].

Sedimentation speed can increase with the presence of flocculants. The overall effect of flocculation is to create a fusion of fine particles into larger particles so that they can easily be deposited.
Merging between particles that can occur if there is contact between these particles. In its application, sedimentation is one of the most economical ways to separate solids from suspension, pulp or slurry. Sedimentation is also a process of separating solids in liquids which is often used in industry / factories and at the laboratory scale. Sedimentation can take place in batches or continuously, where in sedimentation in batches which are usually used at the laboratory scale, this is because at the laboratory scale experiments are carried out in stages (batch) not continuously (continuously) as in the industry / factory. One concrete example that requires sedimentation equipment is at the Laboratory of the Department of Chemical Samarinda State Polytechnic. In the Laboratory of Chemical Engineering, Samarinda State Polytechnic, namely the Laboratory of Operations and the Waste & Utilities Laboratory, sedimentation equipment is needed to support the smooth running of the practicum and it is arguably still limited. Therefore, through this Basic Research (Research and Development Prototype Scheme), researchers try to make sedimentation devices in batch modification which is expected to help the implementation of experiments or experiments for the smooth sedimentation practicum in Samarinda State Polytechnic, especially in the Chemical Engineering Department and specifically in the Laboratory of Operations Unit and Waste & Utilities Laboratory.

2. Research Methods
The method used in this research is analysis and analysis. To support the implementation of this research, research subjects are needed. The subjects in this study are as follows: 1). Media: As the media in this study are solids in the form of precipitation materials and liquid in the form of water. 2). Sample: What is taken as a sample is a mixture of media that is water and depositional material (solids) where the depositional material has previously been sieved and cleaned of impurities. 3). Variables: The variables of this study are deposition time, deposition height, suspension concentration and concentration of flocculant addition

2.1. Tools and materials
The tools used in a batch sedimentation tool include: Caliper, analytical balance, Stop watch, beaker, mortar & pestle, screen (screening), spatula, plastic spoon and bucket While the material used: PDAM water, Flocculant Material: Alum (Aluminum Sulfate (Al2 (SO3) 4)) , Precipitating material: Lime (CaCO3), Wheat Flour, Soil (Dry), and Activated Carbon

2.2. Work procedures
Making batch sedimentation equipment is carried out at Samarinda State Polytechnic campus in the Laboratory of Operations Unit of the Chemical Engineering Department. As for the following Work Procedures as follows:
1. Trial sedimentation without flocculants
   a. Sift the settling material to be used and weigh the settling material as much as 50 grams, 100 grams, 150 grams, 200 grams, and 250 grams, then transfer it to the settling tube.
   b. Add water until it reaches a height of 70 cm
   c. Shake the mixture by turning the 900 tube 10 times then let it sit and remove the tube cover
   d. Observe and record the height of the suspension every 5 minutes until it is constant.
2. Trial Sedimentation experiments with the addition of flocculants
   a. Sift the settling material to be used to obtain a more uniform particle diameter of the settling material
   b. Weigh the depositor material as much as 50 grams, 100 grams, 150 grams, 200 grams, and 250 grams then transfer it to the settling tube.
   c. Add water to reach a height of 80 cm then cover the tube with each lid.
   d. Weigh the flocculant each 1 gram, then transfer it to the settling tube which contains a mixture of water-settling material and the tube must be closed.
   e. Stir the mixture by flipping the tube so that the concentration of suspense is evenly distributed.
   f. Then set aside the cylinder and remove the cylinder lid and run the stopwatch.
   g. Observe and record the height of the suspension every 5 minutes until it is constant.
   h. Repeat the above steps by adding 2 grams of flocculants, 3 grams, 4 grams and 5 grams
3. Results and discussion

3.1. CaCO$_3$ Residual materials

In determining the deposition speed of CaCO$_3$ without the addition of coagulant can be determined by the graph of the relationship between the height of the compressible zone Vs of time. In the graph it can be seen that the more mass of solids added to the tube, the longer the time needed for the floces formed to settle.
Furthermore, the deposition of CaCO3 with alum was added as a coagulant. The added coagulant mass is 1 gram into each tube. The function is to add alum as a coagulant so that clumping occurs between alum and floc in the water so that the flocks become larger and relatively heavier, causing suspended particles to settle faster with the addition of alum.

3.2. Tapioca Flour Residual Materials

In determining the deposition speed of tapioca flour without the addition of coagulant can be determined by the graph of the relationship between the height of the compressible zone Vs of time. In the graph it can be seen that the more mass of solids added to the tube, the longer the time needed for the floces formed to settle.
Furthermore, the deposition of tapioca flour with alum was added as a coagulant. The added coagulant mass is 1 gram into each tube. The function is to add alum as a coagulant so that clumping occurs between alum and floc in the water so that the flocks become larger and relatively heavier, causing suspended particles to settle faster with the addition of alum.

3.3. Dry Soil Residual Materials

In determining the deposition speed of dry soil without the addition of coagulant can be determined by the graph of the relationship between the height of the compressible zone Vs of time. In the graph it can be seen that the more mass of solids added to the tube, the longer the time needed for the floces formed to settle.
Furthermore, the deposition of dry soil with alum was added as a coagulant. The added coagulant mass is 1 gram into each tube. The function is to add alum as a coagulant so that clumping occurs between alum and floc in the water so that the flocks become larger and relatively heavier, causing suspended particles to settle faster with the addition of alum.

3.4. Activated Carbon Residual Materials

Furthermore, the deposition of dry soil with alum was added as a coagulant. The added coagulant mass is 1 gram into each tube. The function is to add alum as a coagulant so that clumping occurs between alum and floc in the water so that the flocks become larger and relatively heavier, causing suspended particles to settle faster with the addition of alum.
3.5. Activated Carbon Residual Materials

In determining the deposition speed of activated carbon without the addition of coagulant can be determined by the graph of the relationship between the height of the compressible zone Vs of time. In the graph it can be seen that the more mass of solids added to the tube, the longer the time needed for the floces formed to settle.

Furthermore, the deposition of activated carbon with alum was added as a coagulant. The added coagulant mass is 1 gram into each tube. The function is to add alum as a coagulant so that clumping occurs between alum and floc in the water so that the flocks become larger and relatively heavier, causing suspended particles to settle faster with the addition of alum.

4. Conclusion
From the experiments that have been carried out it can be concluded that The more alum used, the more time is needed to precipitate the formed flocks. The greater the concentration of solids, the smaller the settling speed. The greater the concentration of solids, the greater the sediment obtained.
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