

Compressive Solids Stress In Sedimentation

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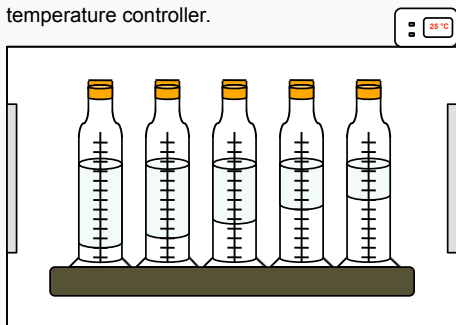
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Introduction

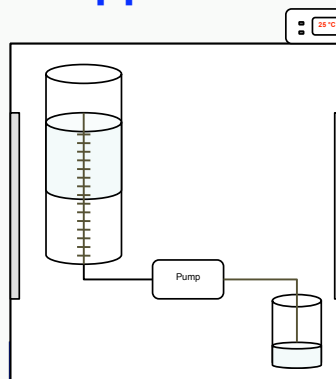
Sedimentation is a simple mechanical separation technique, using a difference in densities between the phases, to cause a solid-liquid separation by gravity. It is a strong function of liquid viscosity and density, particle size, *interaction between particles* and the concentration of the suspension. The purpose of this work, is to understand how colloidal particles interact between themselves over a wide range of shear fields (sedimentation-low; permeation-high). Moreover, the aggregation of colloidal particles in suspensions are widely encountered in the natural world and in a wide range of industries (for example, nuclear, pharmaceutical, foods and water treatment).

Experimental Apparatus

Concerning **sedimentation** tests, five different suspensions of TiO_2 , with five different initial concentrations, were made and kept inside a box equipped with two heater mats connected to a digital temperature controller.



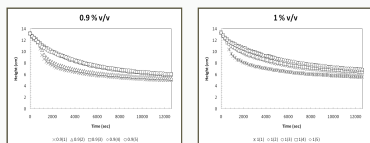
Three parameters were monitored:
• Ionic strength
• pH, and
• temperature



Permeation experiments were performed after sedimentation, under temperature control. The system was constituted by a filter-type cell in which the suspension sedimented; at the bottom of the cell a peristaltic pump was connected. The pump speed was very gentle and it was turned on after keeping the solid sediment for

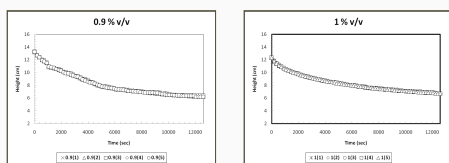
2 days. Permeability and stress were calculated from the liquid drag force as the pressure drop was measured.

Results and Discussion



The change of the height of the interfaces between the supernatants and the suspensions were the first experiments carried out

The reproducibility of the data, at the higher concentrations were achieved only by keeping the system under constant temperature. Five different runs per each value of concentration are shown (above without constant temperature; and below with constant temperature).

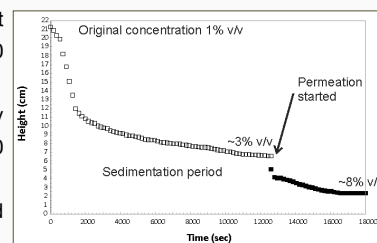


1. This sedimentation test had a duration of 12800 seconds.
2. It was then followed by a permeation test of 5400 seconds.

The test was stopped only when the pipe line

that connected the peristaltic pump with the cell collapsed under the induced vacuum.

The average concentration of the sediment was about 3% v/v at the end of the sedimentation test and about 8% at the end of the permeation test. Considering the batch settling curve, it is possible to distinguish the four stages typical of compressible materials.



Conclusions

The consolidation and permeation of TiO_2 suspensions (P25) due to gravity sedimentation and liquid drag in the presence of electrolytes has been investigated as a function of concentration and pH. The project seeks to investigate and explain the settling behaviour, and other macroscopic properties, of the colloidal aggregates as a function of particle cluster formation and cluster size. Further work is being conducted using direct measurement of cluster size, as a function of applied shear stress, and mathematical modelling of cluster formation.

Bibliography

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