Experimental report

13/02/2017

Proposal: 9-12-359 **Council:** 4/2014

Title: Structure of aggregates - heteroflocculation induced by Moringa seed protein

Research area: Soft condensed matter

This proposal is a new proposal

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Samples: Polystyrene latex
Kaolinite
Moringa seed proteins
water - H2O and D2O

Instrument	Requested days	Allocated days	From	To
D11	3	3	08/12/2014	11/12/2014
D33	3	0		
D22	3	0		

Abstract:

Floc structure and strength play important roles in a range of industrial processes such as particle separation and water treatment. Our proposal will provide key information to test basic ideas of heteroflocculation with particles of different size of particles with different shapes. The determination of how each species is arranged in flocs by using contrast matching to observe the structure overall and arrangement of individual components will allow sensitive tests of models that relate particle volume fraction, dynamics and 'sticking probability'. The results of experiments on latex particles and clay that exploit the novel natural flocculent protein from Moringa seeds will also be directly relevant to the development of new water purification technologies. Experiments are designed specifically to allow initial studies that test simple physical models and to avoid complication of orthokinetic flocculation that arise in strong shear.

Experimental Report 9-12-359: Structure of aggregates - heteroflocculation induced by Moringa seed protein

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This experiment is about flocs and how they are formed in a combination of suspended materials together with a flocculent. For example, efficient water clarification usually involves flocculation induced with either positively charged polyelectrolytes such as synthetic polymers or high valency salts ($FeCl_3$ or $Al_2(SO_4)_3$) to separate the liquid phase from the solid and obtain a clear filtrate. However, in the example of water purification, flocculents are not always used in an optimal way due to the natural fluctuations and heterogeneity of water composition (e.g., pH, ionic composition), suspended particle concentration and corresponding physicochemical properties (e.g., sizes, shapes, surface charges). The structure and strength of the formed flocs play important roles in the separation process in water treatment.

Structures of flocs formed by heterocoagulation are important both in industrial processes and in purification. Advanced models of aggregation suggest that particle dynamics, size and interactions can play an important role in flocculation. Fractal dimensions have been used as an indicator of floc character to enable comparison between different chemicals and operational regimes. In this experiment we investigated binary mixtures both of similar chemistry (two sizes of polystyrene latex labelled using deuterium and hydrogen) and a clay (kaolinite)/deuterated polystyrene latex mixture.

The fractal dimensions and size of the aggregates overall and of both components was determined using SANS and contrast matching. The experiment was performed using mounts for sample cells for study of large particles and aggregates that avoid problems of sedimentation by rotating the samples. We investigated a range of samples of different compositions. One example is shown in Figure 1, showing the flocculation of spherical polystyrene latex particles by flocculent Moringa oleifera protein.

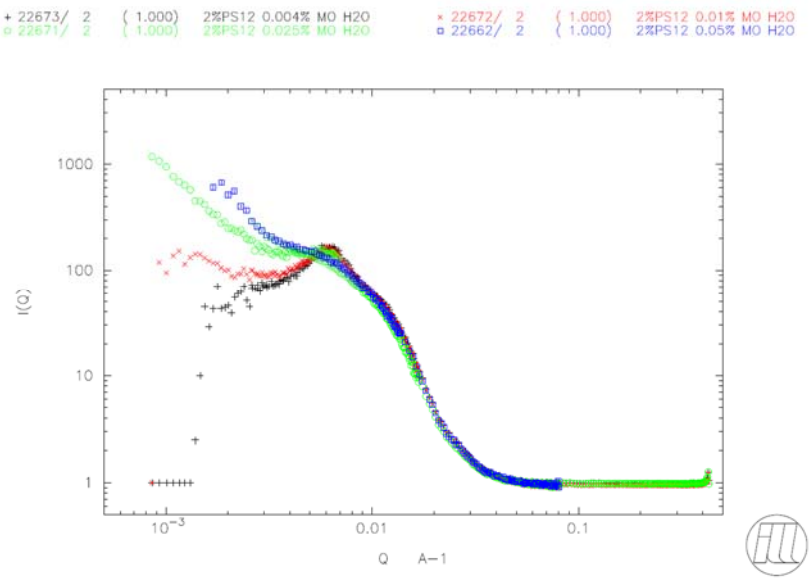

Figure 1. One concentration of polystyrene latex particles and increasing concentrations of Moringa oleifera flocculation protein.