Effects of Salinity on Humic Aggregation

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Introduction

Humic acids are a product of organic decay that can be found in essentially all natural water. This study aims to develop a correlation between the salinity of a given water sample, and the duration required for a humic substance to aggregate.

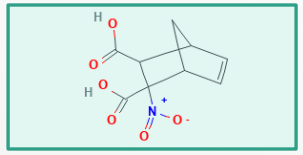


Fig. 1) Structure of a simple humic acid

The tested samples are sheared at 400 Hz and deemed aggregated once a particle size of 5000 nm was detected vial DLS.

Methodology

- A sample of water was collected from an on-campus pond.

Fig. 2) South West Pond

- The sample was filtered using a 0.45 µm filter
- The sample was treated with 0.03 wt% Sodium Azide and divided into 6 samples, to which NaCl is added to reach 0.0, 0.1, … 0.5 M, then further divided into 3 vials for testing.
- pH and conductivity values were collected for eac.h of the 18 vials.
- Each vial was placed into a rheometer to shear for 3 minutes at 400 1/s.

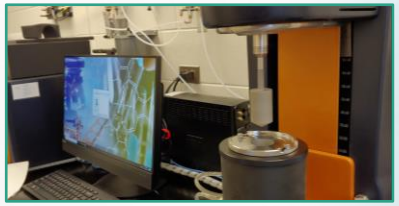


Fig. 3) Rheometer with Bob-and-Cup

- Each sample was immediately transferred to a cuvette and placed in a DLS for up to 1.5 hours.

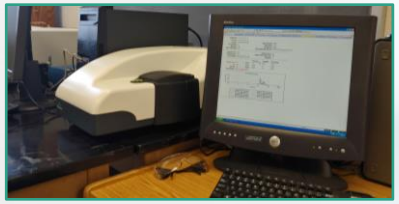
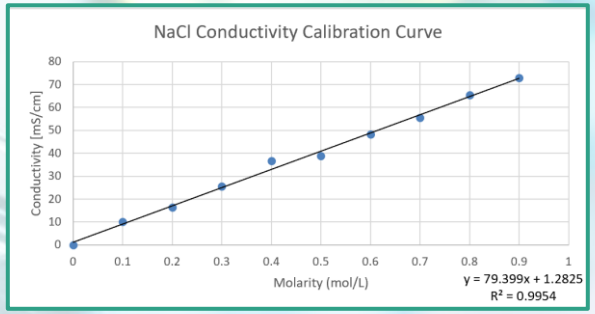


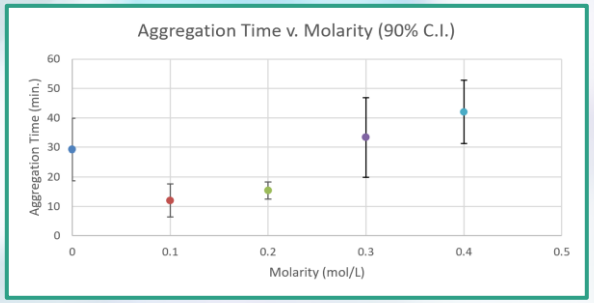
Fig. 4) Dynamic Light Scatterer

Results

- A regular pH average of 7.4 was recorded.



- A calibration curve was generated to ensure the desired molarity is reached.



- The aggregation time was plotted as a function of salinity, including a 90% confidence interval.
- Samples containing 0.0M NaCl were irregular in aggregation period.

Conclusions

Based on the findings of this study, it is concluded that there is a general correlation between salinity and time until aggregation that is estimated by the equation:

$$T_{agg} = 113.3(C_{conc})^2 + 41.3(C_{conc}) + 5.3$$

T_{agg} ≡ aggregation time (minutes)
C_{conc} ≡ concentration (mol/L)

In this study, an aggregation of the 0.5 M sample was not observed, though it would be expected to aggregate between 55 and 65 minutes. Future iterations of this study would focus on how significant changes in environmental factors such as pH, dissolved oxygen, and shear rate along with the application of varying ions could affect the aggregation trend observed.

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