

Tanapong (Nont) Jiarathanakul's Individual Contribution Page

Spring 2014 Contributions

This semester I am in charge of the Graphite Furnace Atomic Absorption Spectrometer (GFAAS). After a full semester of repairs and modifications by William Pennock, the GFAAS is almost fully operational. Before testing with samples, there were a few alignments and calibrations that needed to be done.

Currently, the arsenic lamp that is used for emitting arsenic wavelength is on loan from Perkin Elmer. Therefore, we wanted to replace this with a newly purchase lamp that is owned by AguaClara. I installed this lamp and attempted to align it. However, a few issues arose. First, the new lamp was not capable of generating an adequate amount of energy for the machine. The old lamp was able to emit at an energy of 37 while the new lamp could only emit 33. This caused problems when aligning the furnace as the machine did not even recognize any light emitting from the lamp. Therefore, we decided to use the old lamp for the time being. Professor Weber-Shirk will contact Perkin Elmer to address this issue.

Next, I tested the capacity of the GFAAS to detect arsenic at low concentration to ensure accuracy. First, I created a calibration curve ranging from 0 to 10 ppb with a standard concentration of 10 ppb at an interval of 2 ppb with automated dilution by the GFAAS using normal sampling procedure. The resulting data had a large standard deviation among the triplicate values, which made this method statistically not viable for sampling at low concentration with a detection limit at only approximately 8.1 ppb. In order to obtain better accuracy, the mass of arsenic in the analysis has increase. This can be done using two methods. The first method is called multiple injection method. The furnace sequence can be programmed to inject the sample into the furnace chamber multiple times and burn off excess liquid in between each injection. I programmed the furnace to inject the sample 5 times into the furnace in order to increase the mass of arsenic by 5 times. The resulting calibration curve had a polynomial trend line with R-square value of 0.85. The second method is called large injection method. As the name implies, the GFAAS was programmed to inject a larger volume of sample into the furnace chamber. Normally, 20 microliters are injected, but in this test, 50 microliters were used instead. The resulting calibration curve had a strong linear trend with R-square value of 0.998, which showed that the trend line matched that data almost perfectly. In conclusion, large injection method should be used in future studies to evaluate arsenic contaminated samples at low concentration.

Fall 2013 Contributions

This semester the Arsenic Team was in its preparation phase. Since the GFAAS (Graphite Furnace Atomic Adsorption Spectrometer) is currently non-functional, the team concentrated the efforts in preparing the lab for upcoming experiments as well as creating standard testing procedures. I have supported the team by location and searching for necessary chemicals for the upcoming experiments. This semester, we require groundwater solution, which will be used as the basis for our sample solution. We also need diluted arsenic solution, nitric acid and permanganate. I also determined the sample tubes as main vessel for our experiment. This test tube has to fit in both the centrifuge and the carousel tray in the GFAAS. Professor Richardson gave us a variety of centrifugal tubes to test. These tubes come in two sizes both with sloped bottoms: 1,000 uL and 500 uL. Unfortunately, both sizes do not find the carousel slot. The large one is simply too wide, and the small one is too tall. The GFAAS also has its own 500 uL tube, which fits the carousel perfectly. However, it does not fit any centrifuge in available. Therefore, I came up with a hybrid solution, which is to place the small centrifugal tube inside the GFAAS tube when placing in the carousel. However, I will have to ensure that this odd configuration of tubes will not impede the machine in any ways. I also acquired a tube with filter basket, which we will use to emulate filtration.

Besides preparation, I also contributed to literature research. My main focus was on a paper by Katsoyiannis and Zouboulis on adsorptive filtration using coated polymeric materials, which is an emerging technology in water treatment process. The experiments in this study may be outside of our scope this semester. However, it provided us with possible alternatives to remove arsenic in groundwater, which we may study more intensively in the upcoming semesters.

As for the standard testing procedure experiment, I determined that there are four possible testing configurations. First, we can use regular centrifuge tube to mimic sedimentation. Second, the newly acquired tube with filter basket can be used to emulate filtration. Third, we can pre-treated the filter with coagulant to create adsorptive filtration. Last, we can add additional coagulant dose to the sample to mimic both normal flocculation and adsorptive filtration. Since we cannot use arsenic in our experiment, we used clay instead to observe the removal efficacy of these methods. We used a groundwater sample with turbidity of 5 NTU and 3 concentrations of PACl (2, 20 and 200 mg/L). The results are promising. Both coated and non-coated filtration methods were able to reduce the turbidity close to zero. However, there were some problems with sedimentation. I suspected that when we transferred sample from centrifuge tube to the spectrometer, we disturbed the sample and caused resuspension, thus tampering the results.