Polyacrylamide Synthesis through UV and Electron Beam Radiation

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Purpose: Some polymer systems can undergo functionalization, creating a new polymer for desired purposes. Acrylamide is a relatively cheap monomer that is beneficial to use in research for functionalization purposes such as the transformation of the amide functional group into an amine group. This often occurs using the stable polymer of acrylamide, polyacrylamide. Polyacrylamide is a highly water-swellable polymer that is often used for water treatment, oil industries and agriculture purposes. In this experiment, polyacrylamide will be synthesized through UV light curing and an electron beam irradiation. The gels created through both methods are then analyzed through techniques such as Fourier-Transform Infrared Spectroscopy (FTIR) and microscopy to observe differences in both polymerization methods.

Methods: Both solutions were created using pure acrylamide powder, deionized water and trimethylolpropane triacrylate as a crosslinker. The acrylamide powder was dissolved in deionized water on a hotplate with consistent stirring. The crosslinker was then added to each solution and thoroughly mixed in. For the solution that was UV cured, a photoinitiator was added. The polymer solutions were transferred into petri dishes and cured with their desired energy source. The electron beam gels were cured in air at Rapid Cure Technologies. Fusion UV Curing took place at SUNY ESF utilizing a D bulb.

Results: The results have not been finished yet and will be determined based on the completion of the experiment. Molecular weight distributions will be determined by GPC (Gel Permeation Chromatography) and the chemical structures will be determined by Fourier-Transform Infrared Spectroscopy analysis. The porosity of the gels will be observed by microscopy.

Conclusions: This research project is beneficial to the Ionization Radiation area of research by determining ways in which radiation is most successful at polymerization and the creation of hydrogels when compared to chemical processes. By determining how ionizing radiation can benefit the creation of important polymers, we can expand the usage of ionizing radiation for social benefits within different industries such as gas, oil and agriculture. The practical use of ionizing radiation can be increased if polymers that help these industries are easily created through these methods.