COLLEGE OF ENGINEERING
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Research and Creative Experience for Undergraduates Program (RCEU)
Summer 2017

HONORS COLLEGE
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Using Better Solvents to Functionalize Glass with Chlorotrimethylsilane

Jonathan Cookston and Dr. Jeffrey J. Weimer
Department of Chemical and Materials Engineering

Introduction

Glass treated with chlorotrimethylsilane (CTMS or $(CH_3)_3SiCl$) has increased hydrophobicity. Previous work used toluene as a solvent [1]. The role of solvent was unknown.

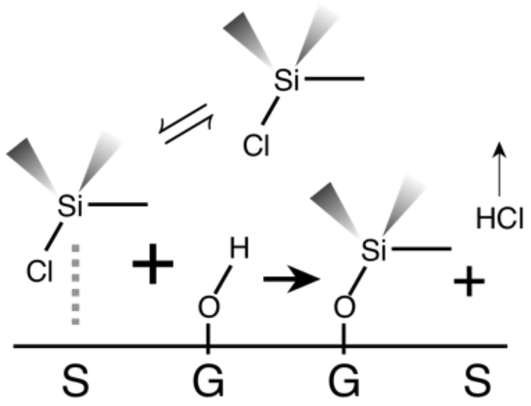

Figure 1: Silane deposition on glass substrate

Solvents were chosen based on green and biocompatible scores as per the GSK solvent selection guide [2].

Solvent	Green	Biocompatible	Volatility
Toluene	3	4	Low
Acetonitrile	6	6	Moderate
Ethyl Acetate	8	8	Moderate

1 – 10
Unacceptable - Ideal

Materials and Methods

- Cleaning –
  - 1:1 hydrochloric acid:methanol 30 min.
  - Concentrated sulfuric acid for 30 min.
- Silanation –
  - 0.1 V% or 10 V% CTMS for 20 min.
- Contact angle measurement –
  - Ramé-Hart goniometer.
  - 4.00 µL drops of deionized water.
  - DROPimage software.

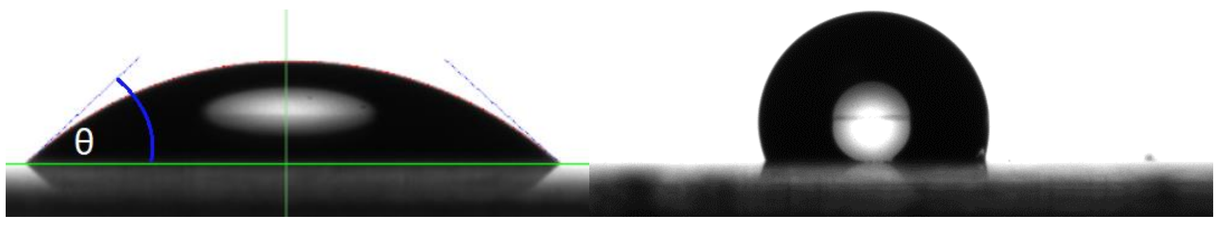

Figure 2: Wetting and non-wetting contact angles

Results and Discussion

Ten replicants of contact angles of water were measured per solution and concentration. The weighted average and weighted standard deviation determined the height and error bars.

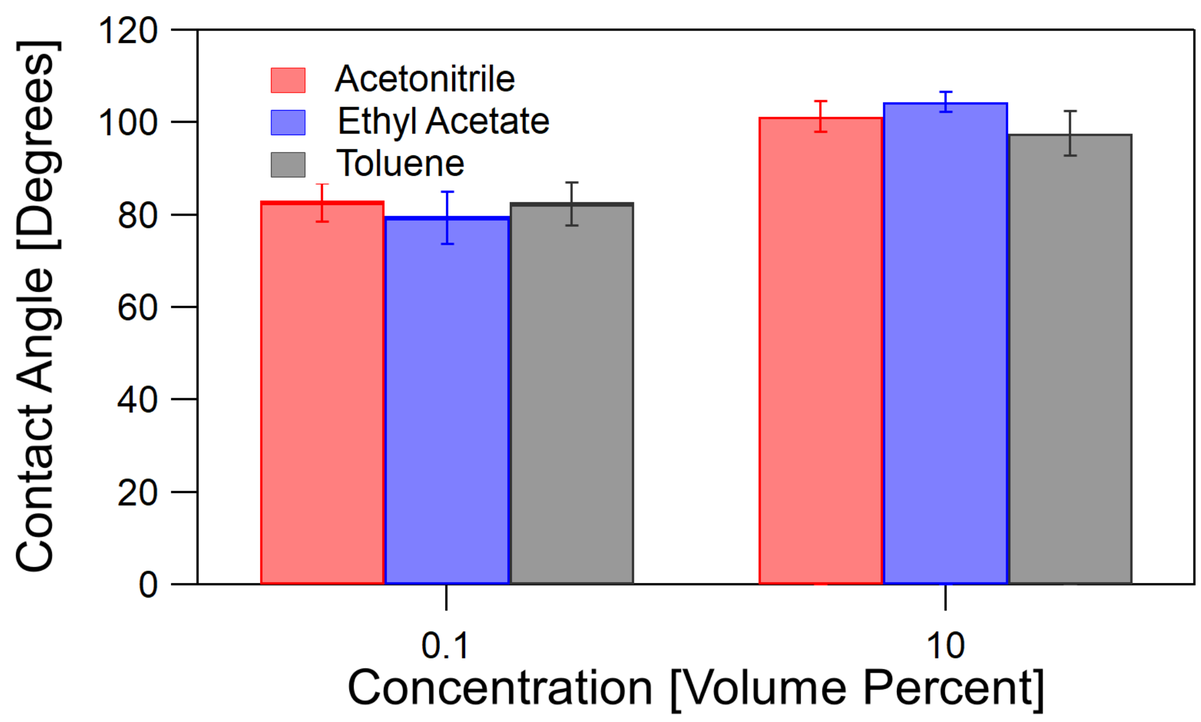

Figure 3: Contact angles for various solvents

Conclusion

Overlap suggests no significant difference between solvents. Further work is needed to fill out the uptake curves across a range of concentrations. This will be accomplished as an Honors Research Capstone project.

References

[1] Maharanwar, A.; Weimer, J. J. Surfaces and Interfaces 2017, 7, 29-38
[2] GSK Solvent Selection Guide 2009, Supplementary Material for Green Chemistry, The Royal Society of Chemistry 2010

Acknowledgements

- Aniket Maharanwar for consultation
- The UAH Honors College
- The UAH Chemistry Department for funding
- Dr. Sundar Christopher for funding
- Dr. Vogler and David Cook for RCEU organization