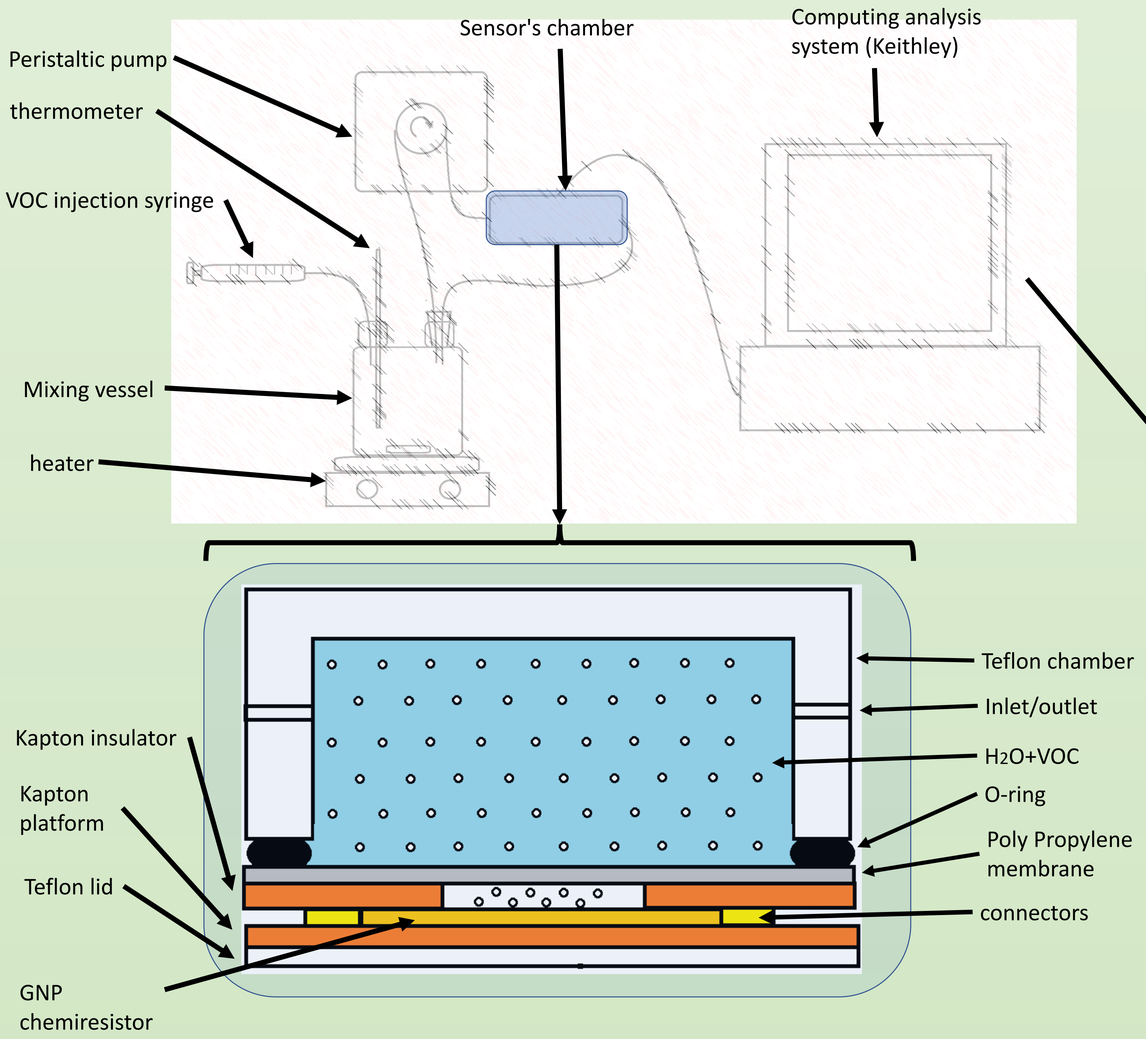
Detection of Volatile Organic Compounds in Liquid Environment via Custom-Made System of Gold nanoparticle-Based Sensors

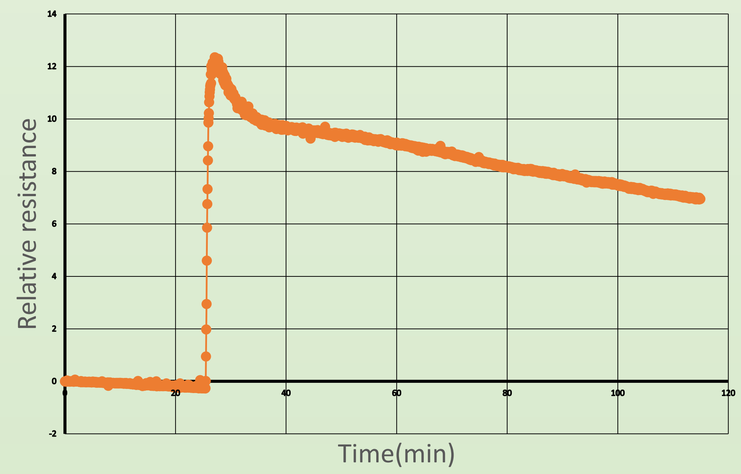
Ron Ianovici and prof HaicK Hossam : *Department of Chemical Engineering, Technion – Israel Institute of Technology, Haifa 3200003, Israel*

Introduction and Objectives

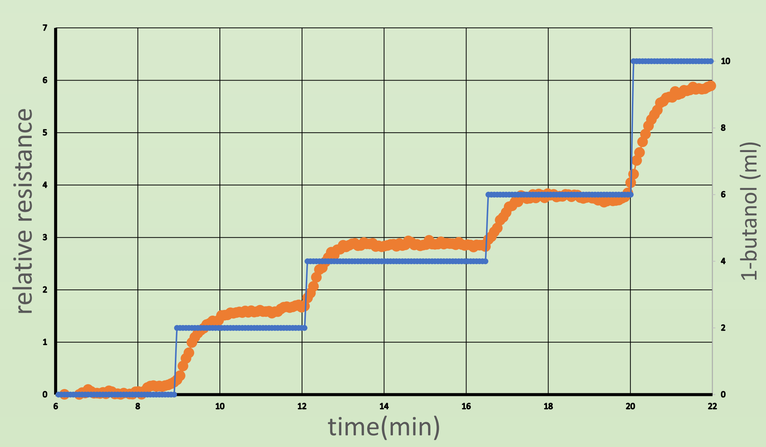
Volatile organic compound (VOC) are organic chemicals that have a high vapor pressure at room temperature. High vapor pressure correlates with a low boiling point. VOCs are responsible for the odor, scents, and perfumes as well as pollutants. Some VOCs are dangerous to human health or cause harm to the environment. VOCs are also considered as a promising candidate for health diagnosis and monitoring via blood, urine, saliva and more body fluids, including communicable and non-communicable diseases. Nevertheless, to bring this capability into a point-of-care settings, there is a need to design, developed and test fast, inexpensive and repeatable chemical sensors. In this work, I present the design and production of custom-made system based on molecularly-modified gold nanoparticle sensor arrays coated with biocompatible membranes.

Results





The relative resistance response of GNP chemirestor sensors to water creating a ~90% humidity on the sensors interface
T=room temp (21 °C)



normalized relative resistance response of GNP sensors(orange) to addition of VOC (blue)
VOC = 1-butanol
V (H_2O) = 540 ml
T=room temp (21 °C)

Results

- The designed system is able to detect and discriminate polar and nonpolar VOCs and, furthermore, can distinguish them from confounding VOCs or other compounds in the same environment.
- Relative resistance of tert-dodecanethiol modified GNP to H_2O showed initial change of ~10% followed by constant trend of ~-0.3 RR per min followed by response to 1-butanol that showed a change of ~0.8% per 1(ml) VOC at 0-19 ml range of addition to 540(ml) H_2O.

Urine analysis

By using different functional groups, which show different responses to different VOCs, one can create a sensor array to differentiate between VOCs and measure their concentrations. Such a system could potentially make every encounter with the toilet, a health test.

Conclusions

- Thiol modified gold nano particles covered by polypropylene hydrophobic membrane showed water resistance properties.
- The relative resistance response to 1ml of 1-butanol in 240ml H2O showed a change of ~0.8%

Acknowledgment

I would like to thank Prof. H. Haick for the help and guidance in this project.