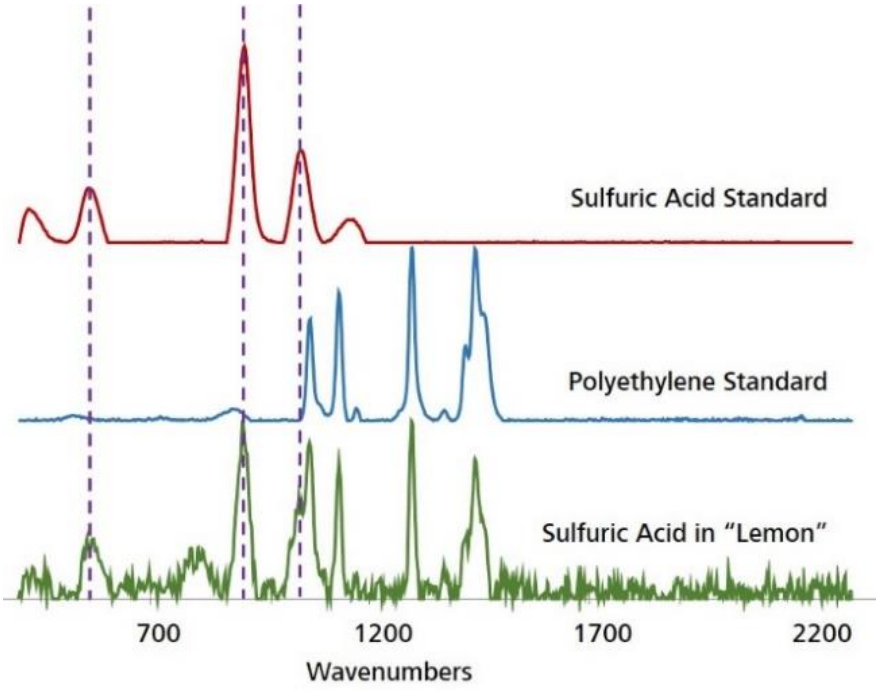
Raman Spectroscopy Application Note RS-12

Acid Attack Prevention: Identification of Acids through a Novel Plastic Container



Acid throwing, a historical method for retribution against women, has become a modern threat of a different nature. Concentrated acids and other corrosive substances have emerged as modern tools of social violence. Aggressors use common plastic containers with openings that create a powerful directional spray, such as lemon juice squeeze bottles. Sulfuric and phosphoric acids were chosen for analysis here due to their highly corrosive nature- acid attacks in London most commonly use sulfuric, phosphoric, and nitric acids.

2017 saw a remarkable number of acid attacks in the UK, with reported incidences averaging 2x a day. Detection and regulation of acids may contribute to prevention of this social scourge.

Metrohm Raman

Method description

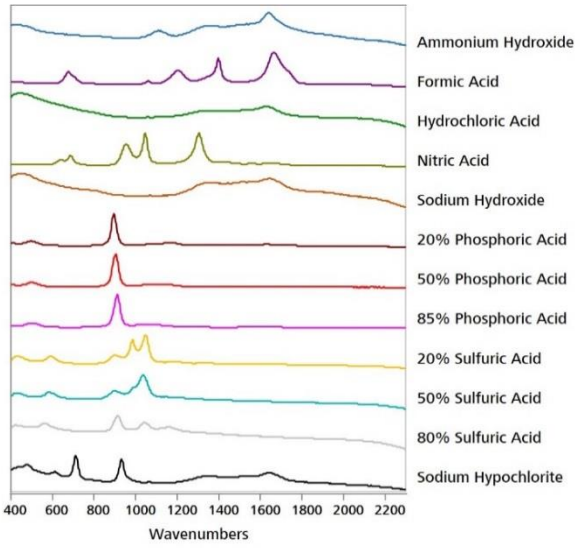
Sample

Raman spectra of 8 strongly corrosive acids and bases were collected in a vial and through the material of a plastic squeeze lemon.

Sample Preparation

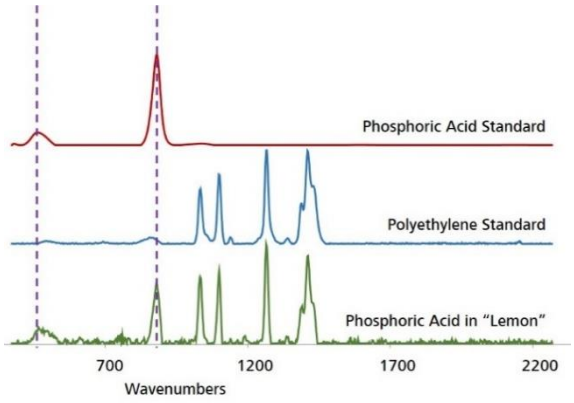
All acids/bases were sampled in glass vials for initial analysis. Polyprotic acid dilution shows the sensitivity of Raman to protonation state. Next, phosphoric acid was introduced into a plastic squeeze lemon and analyzed through the plastic. Sulfuric acid was treated identically.

Most acids/bases were sampled in their concentrated state. Sodium hydroxide was prepared as a saturated aqueous solution. Water was used to prepare acid dilutions.



Analysis

Samples in glass vials were analyzed with the Vial Holder attachment on Mira DS. The Long Working Distance (LWD) attachment (focal length= 8mm) was used to collect spectra through the side of the plastic squeeze lemon.

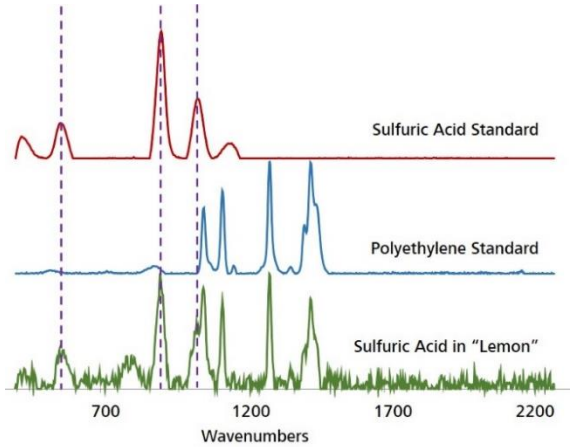


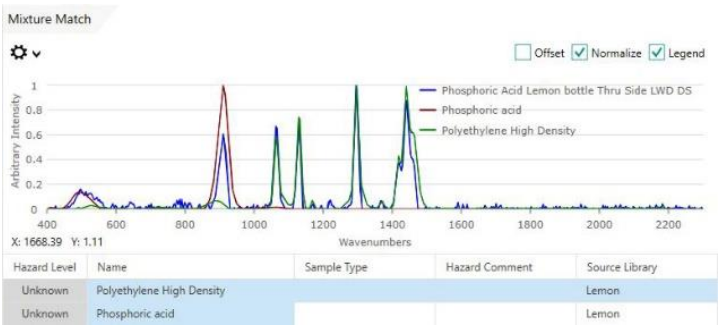
Parameters

Instrument Model	Mira DS
Wavelength	785 nm
Attachments	Vial Holder
	LWD
Software	MiraCal DS 1.0.44
Integration Time	10 seconds
Laser Power	5
# of Averages	5

Results

A distinct spectrum was acquired for each acid/base. Comparison of standard and experimental spectra confirms peak presence from both acid and container (High Density Polyethylene, PET.) MiraCal DS Mixture Matching analysis, below, supports these results, identifying both acid and PET.





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