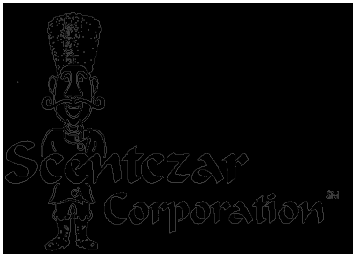


Presentation Overview

- Pavement Monitor Concept
- Project Evolution
- Scatterometer Development
- Spectrometer Development



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Pavement Monitor Concept

- Suite of instruments to detect:
 - Presence of a water film on pavement
 - Concentration of deicing/anti-icing materials in water film
 - Pavement temperature
- Use optical and infrared sensors that can remotely detect pavement conditions



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Pavement Monitor Applications

- Trigger warning signs
- Trigger automatic deicing system
- Maintain adequate concentrations of deicing material on pavement
- Prevent excessive use of deicing materials to reduce cost and environmental effects



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Why Non-Contact?

- Replace current imbedded pavement sensors.
- Measure parameters over a large area.
- Take advantage of new technology.
- Mobile applications.



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Products

Short Term

- Pole mounted applications.
- Integrate pavement monitor into *Weather Scene*.

Long Term

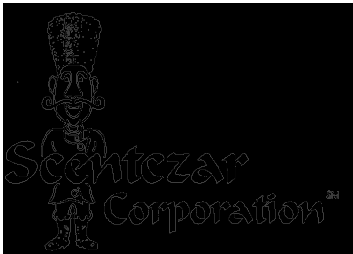
- Mount pavement monitor onto vehicles.



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Project Evolution

- Started development effort in 1999.
- McQ hired Scentczar Corporation to carry out chemistry research and laboratory testing.
- Focused on two sensor technologies:
 - Scatterometer to detect presence of a water film.
 - Infrared spectrometer to detect concentration of deicing materials.



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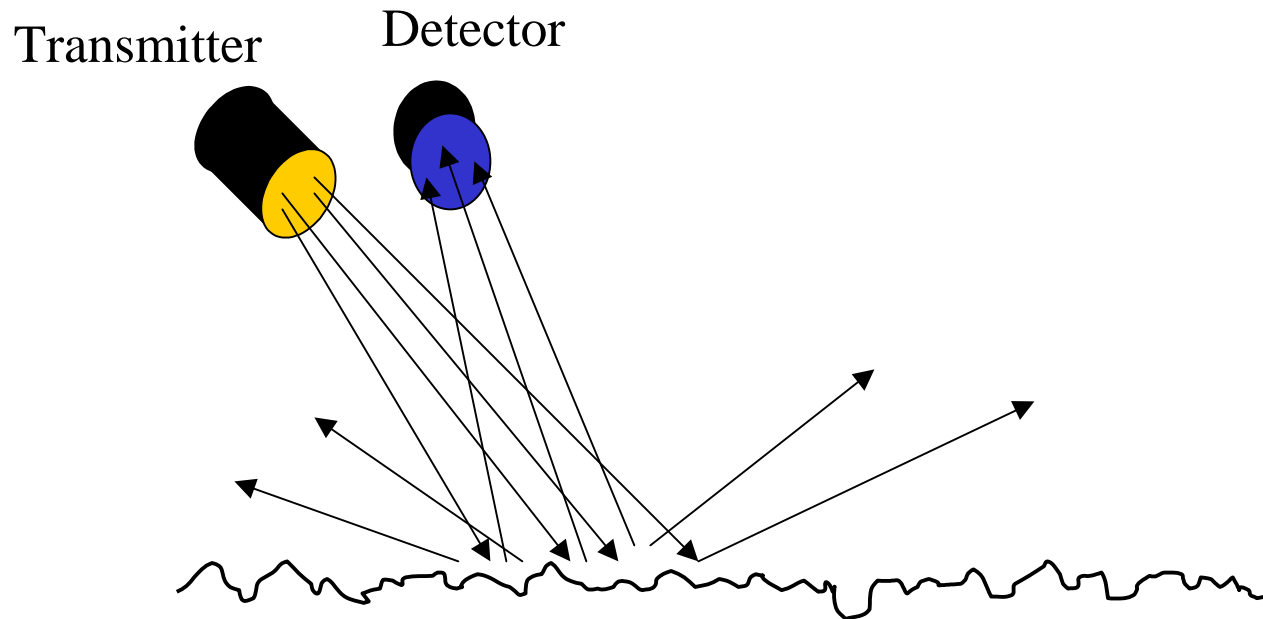
Scatterometer Development

- Purpose: To detect a water film over pavement by monitoring the change in the light scattering properties of the pavement.
- Funding: McQ Associates
- Technology: Use a modified visiometer



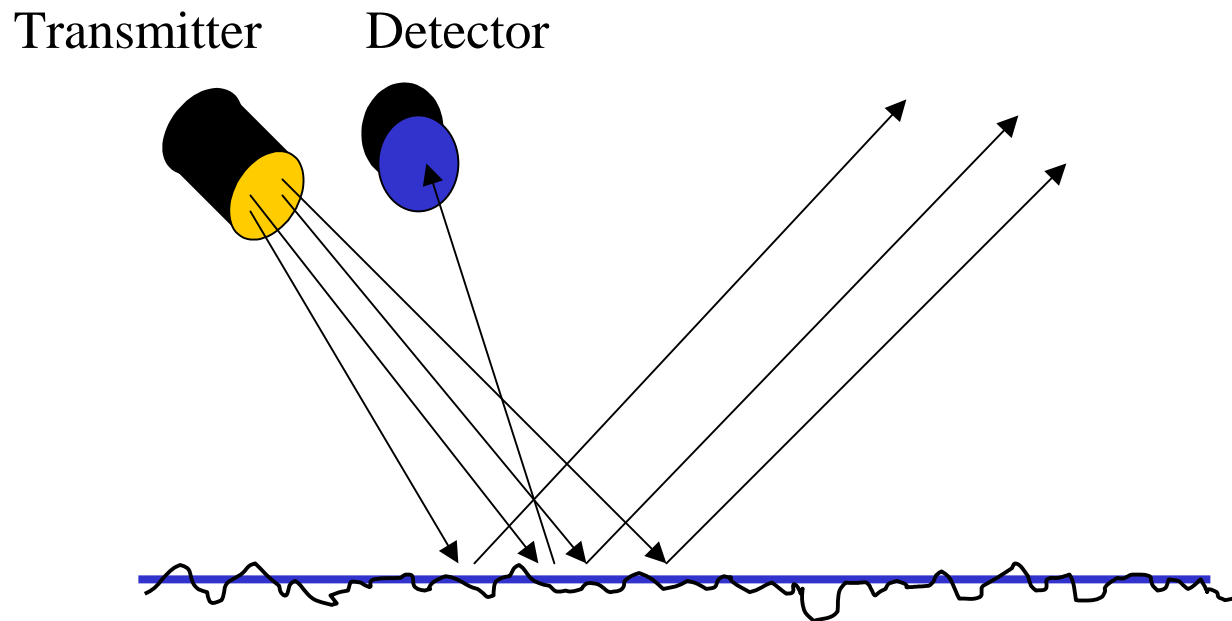
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Detecting Dry Pavement

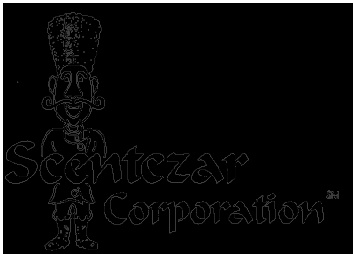


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Detecting Water Layer



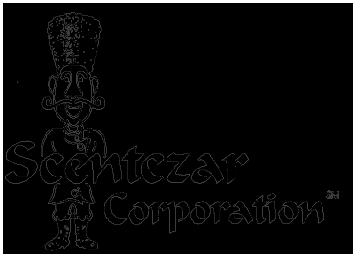
Water Layer = Low Backscatter



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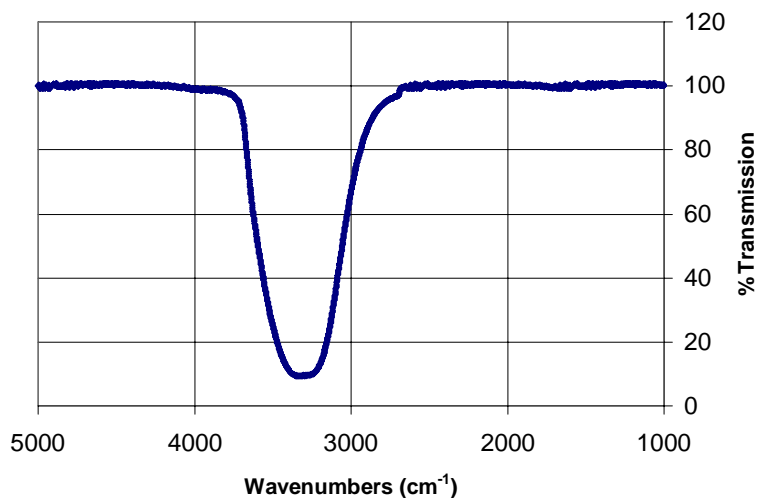
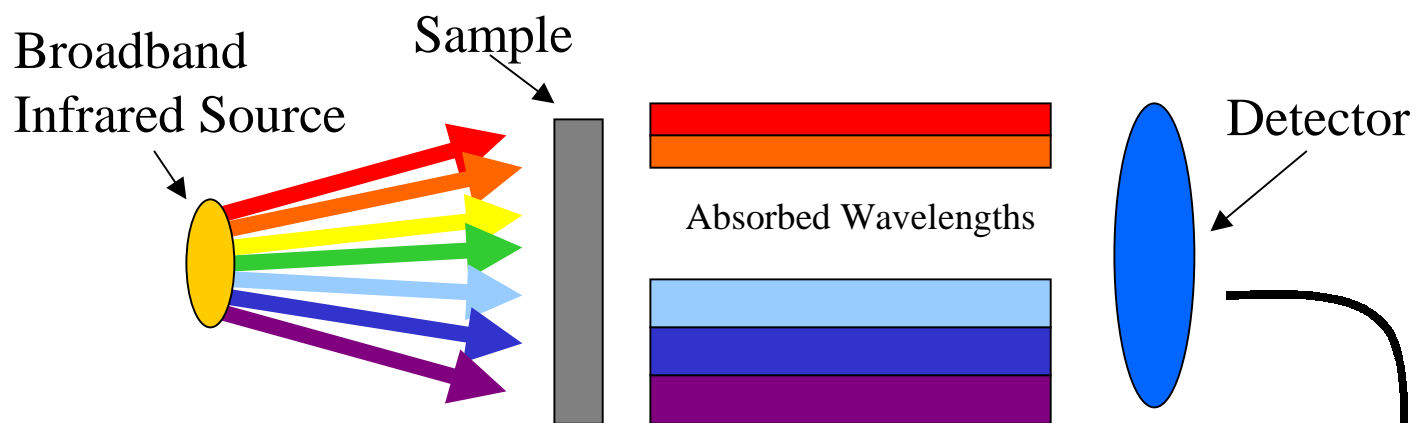
Summary of Results

Experimental Conditions	Percent Change from Dry Pavement
18" Backscatter 3 mm Water Layer Concrete Paving Block	55 % Decrease in Backscatter
54" Backscatter Wet Pavement Asphalt	83 % Decrease in Backscatter
88" Backscatter Wet Pavement Rough Concrete	40 % Decrease in Backscatter
88" Backscatter Wet Pavement Smooth Blacktop	57 % Decrease in Backscatter

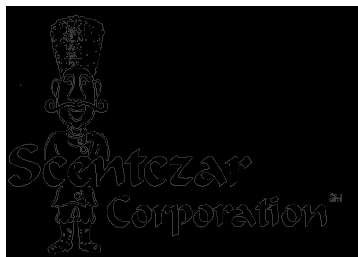


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Infrared Spectroscopy

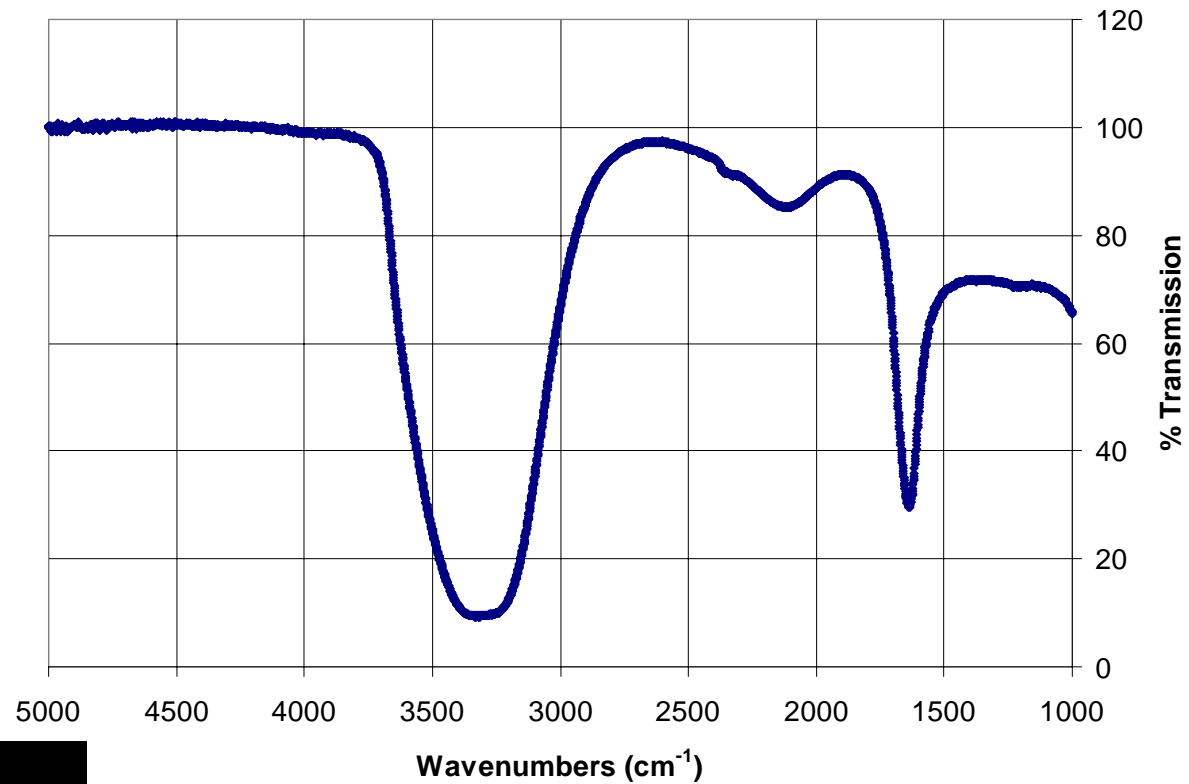


Information Displayed as a Spectrum



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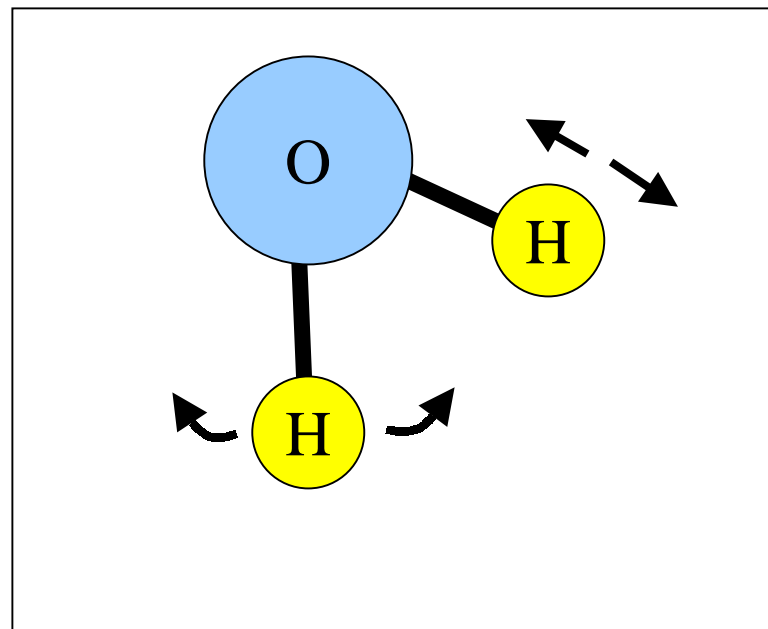
Mid-Infrared Water Spectrum



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Absorbing Infrared Light

- Molecules absorb infrared light by converting the light energy into motion.
- Atoms within the molecule move relative to each other.
- Ionic salts do not absorb infrared light because they do not have covalent bonds.



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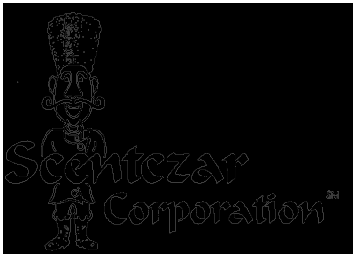
Deicing Materials

Ionic Compounds Shift Water Peaks

- Sodium Chloride, Calcium Chloride, Magnesium Chloride.

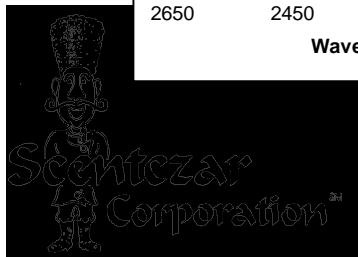
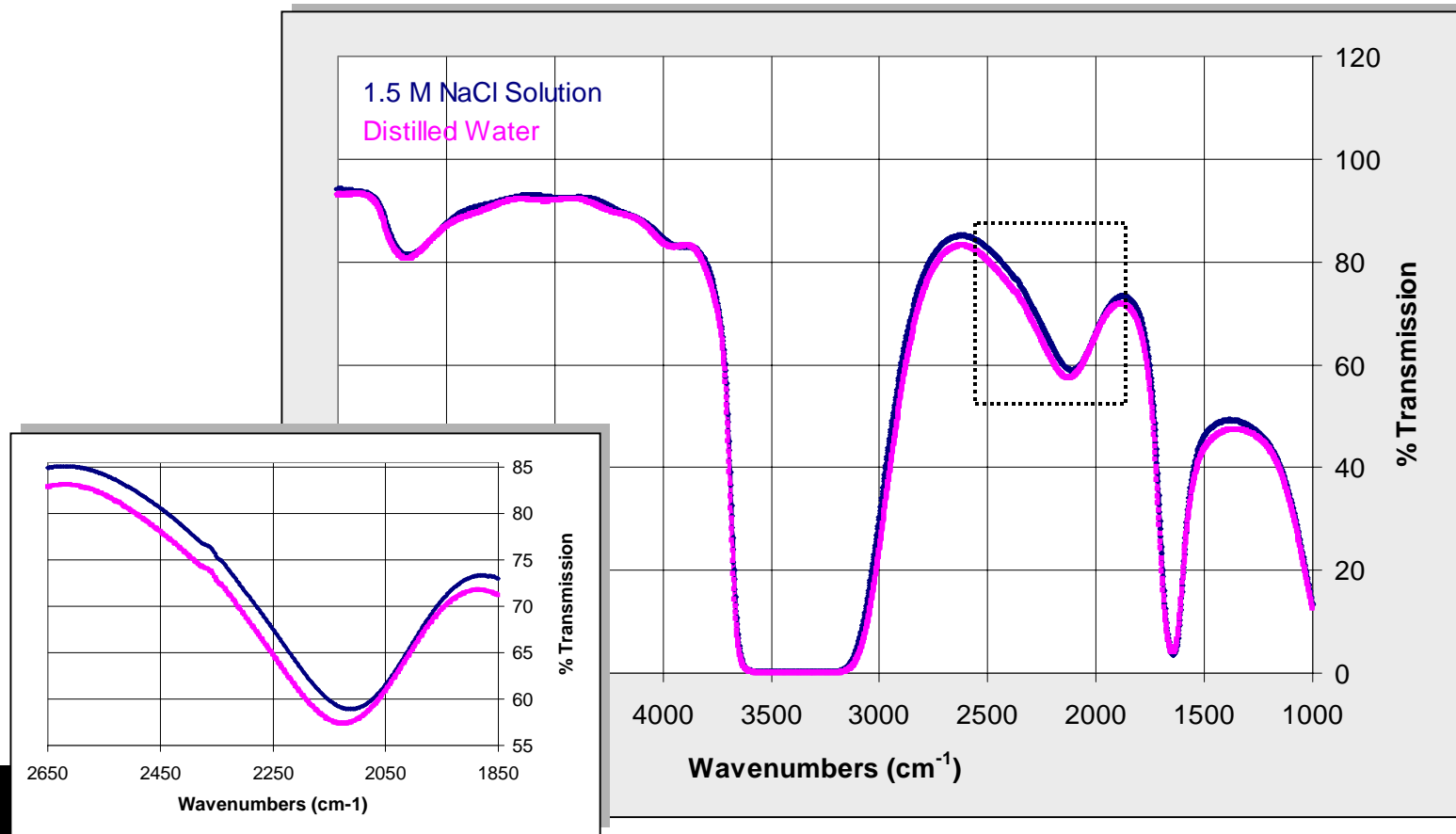
Compound with Covalent Bonds Form New Peaks

- Potassium Acetate, Sodium Acetate, Calcium Magnesium Acetate.
- Propylene Glycol.
- Sodium Formate.



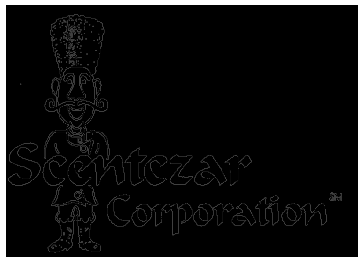
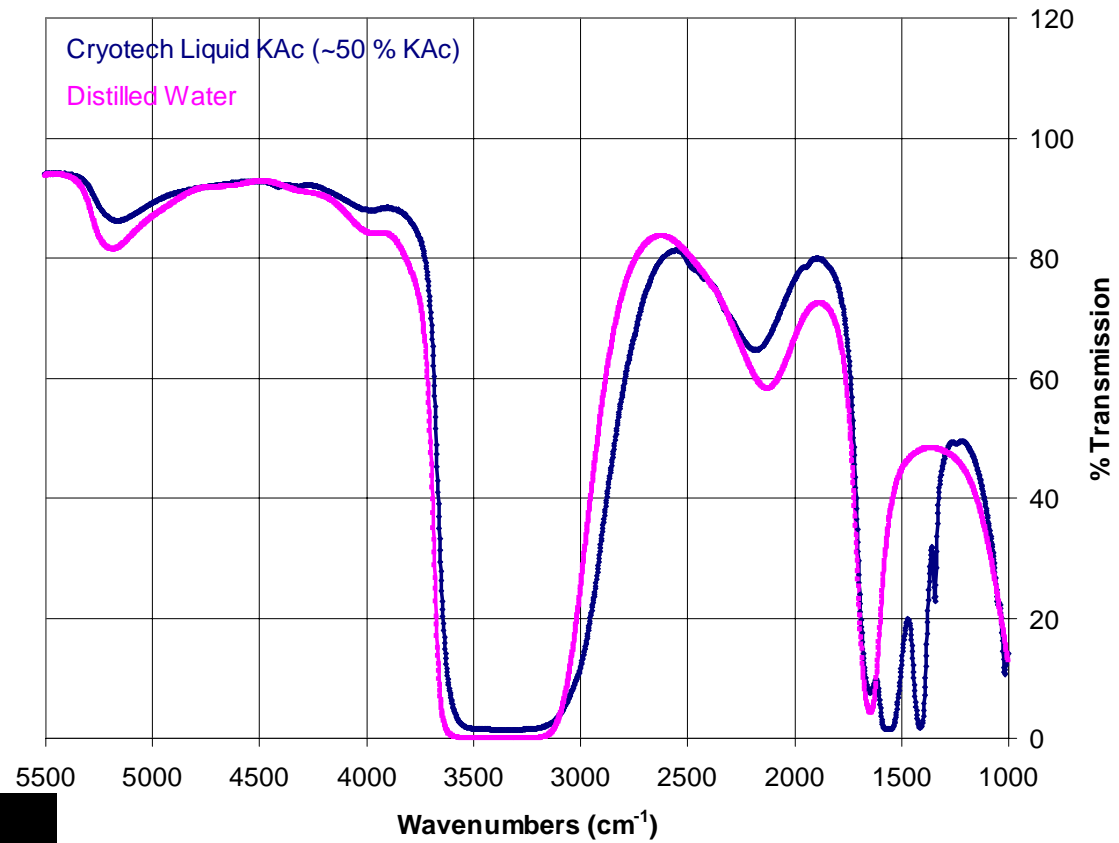
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Sodium Chloride

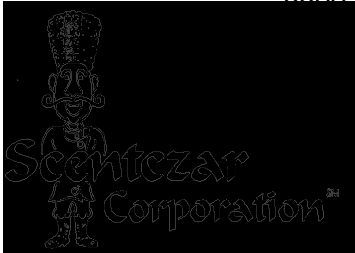
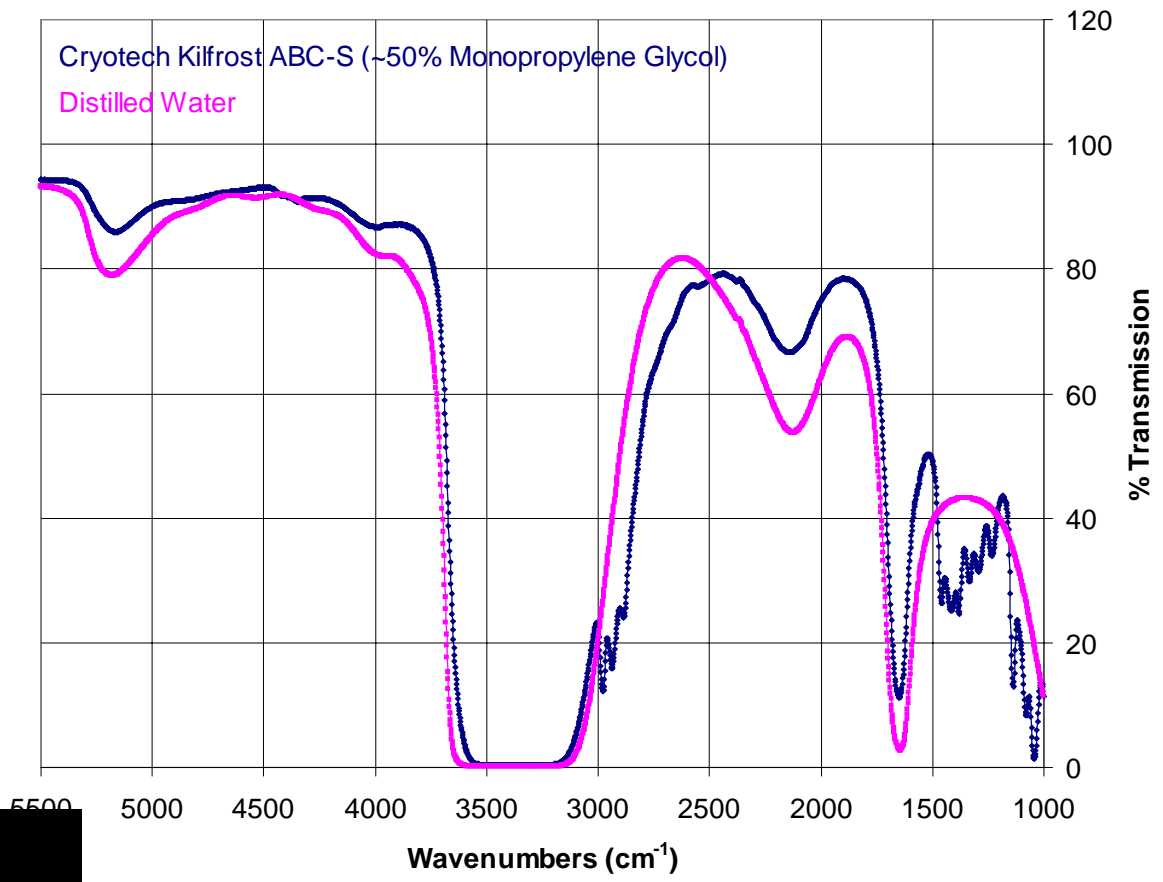


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Potassium Acetate



Propylene Glycol



Build Prototype of New Sensor

- Simpler and cheaper than laboratory spectrometer.
- Look at a few wavelength regions.
- McQ Associates will develop sensor, Scentczar will test it.
- Test prototype outdoors.



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