AquaLab Chilled Mirror Volatiles Testing Study Summary

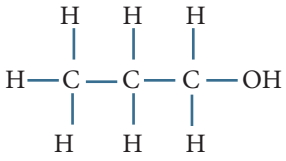
Decagon Devices

• 1-Propanol, Ethanol, and Propylene Glycol all caused chilled mirror readings to go up and to be significantly higher than readings with the volatiles sensor.

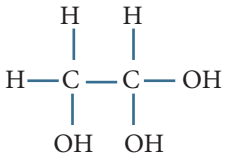
• Glycerin and Hydrogen Peroxide did not cause chilled mirror readings to be different from the volatiles sensor.

• Hydrogen Peroxide actually caused all water activity readings to increase, for both the chilled mirror and volatiles sensor. This is likely due to it being a very similar molecule to water (H_2O_2) and competing with water for hydrogen binding sites.

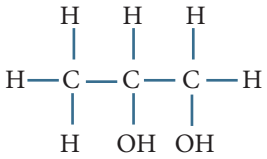
1-Propanol



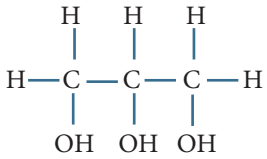
Ethanol



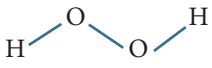
Propylene Glycol



Glycerin



Hydrogen Peroxide



• Comparing the chemical structures for the compounds tested provides interesting information.

• These chemical structures indicate that all of the compounds that caused interference with the chilled mirror readings have both non-polar and polar regions. They each have at least 1 non-polar carbon bonded to just hydrogen. 1-Propanol actually has 2 non-polar carbons and it also caused greater interference with chilled mirror readings than any other compounds. In fact, at high concentration (5%), the chilled mirror tests on 1-Propanol containing samples just kept running and wouldn't complete. The structure of Glycerin and Propylene Glycol are only different in that PG has one non-polar carbon and Glycerin has none. PG causes problems and glycerin does not.

• The actual concentration of volatiles that cause chilled mirror reading problems is matrix specific. Propylene Glycol caused chilled mirror readings to be significantly higher at as low as 0.5% in honey, at 1% in filling, but needed 2%in chocolate syrup and strawberry jam. Ethanol caused significantly different readings at 2% in all substrates. 1-Propanol caused problems at 1% in strawberry jam, at 2% in chocolate syrup, and at 0.5% in honey.

• The commonality of surfactancy for all the compounds that cause problems with chilled mirror readings suggest that surfactant action may play a role in causing problems. All of these compounds, when co-condensing on the mirror with water, would orient themselves with the non-polar region away from the water. This may interfere with the removal of water from the mirror, causing the dew point temperature recorded during mirror warmup to be shifted higher. The average dewpoint temperature used to determine a_w would consequently be higher, resulting in water readings that are artificially high.

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