The purpose of this research is to identify HFO-1234ze, a hydrofluorocarbon difluorocarboxylic acid, using the gas chromatography and the mass spectrometer (GC/MS) instrument. The way we will identify HFO-1234ze is by identifying the ion fragment mass peaks 45, 69, 82, 95, 100, 113, 114, with 82 mass peak being specific to Ze, in a pure air sample. Once this HFO compound is identified we will calibrate Perseus so the Global Monitoring Division (GMD) of NOAA can test for this compound in future air samples.

Why is this important?
This HFO is a new compound that is being introduced into coolant systems in various units such as cars and household air conditioning units. This new coolant has a very low global warming potential (GWP) and has the potential to replace the current HCFCs as coolants. This aligns with the goals set by both the Montreal Protocols, in that it will reduce the production and use of ozone depleting compounds, and Kyoto Protocols whose main goal is to reduce greenhouse gas compounds. Due to the structure of these HFOs they are more easily broken down by OH radicals produced in the atmosphere, and since it does not have a chlorine in its structure, it won’t react with ozone and cause stratospheric ozone depletion. The EPA allowed the application of HFOs in coolant systems in 2011, so this is still a very new compound being introduced. When it becomes more common, the data gained from this research will give the GMD an accurate way to analyze these compounds in the atmosphere.

**Methods**

**Calculations**—We first calculated the ion fragments by calculating combinations of possible fragments that would be broken off the parent chain of the HFO’s structures, these calculations gave the fragments mass peaks 45, 69, 82, 95, 100, 113, 114, with 82 mass peak being specific to HFO-1234ze.

**Dilution**—The dilution was made in a simple mixture of HFO-1234ze and zero air, which is a synthetic blend of oxygen and nitrogen at approximate atmospheric ratios, the final concentration of the dilution was approximately 160 ppt.

**Analysis**—The samples will be introduced into Perseus via an inlet in which the gas will flow from high to low pressure into Perseus. The gas chromatograph (GC) separates the complex mixture of compounds found in the air samples into distinct “peaks,” one for each compound, which are then sequentially introduced into the mass spectrometric detector (MSD). The MSD then bombards each compound with high-energy electrons, this causes the fragmenting and ionizing them into unique charged particles, with relative abundances or “finger prints” that are characteristic of each compound. The quantities of the ionized particle sizes can then be measured by the detector, thus yielding a measure of the atmospheric abundance of each compound.

**Discussion/Conclusion:**

The small peak that is correlated with HFO-1234ze we see in the ambient air sample is most likely due to its short lived life as well as the fact that it was only recently introduced in 2011 and not widely commercially used. The small peak may also be consistent with the idea that since the air sample was taken at a higher elevation, normal air contaminants from a city have not reached and mixed with the air at that elevation.

The peaks shown in figure 6 are consistent with the HFO-1234ze fragments we were looking for and are reasonable for the retention time. Unfortunately, we are uncertain that the abundances on the upper panel of figure 6 are accurate, because there are no known standards to compare this data to. The "noise" on the lower panel could be the cause of contamination in the system, which could have caused us to miss the actual peak of HFO-1234ze. Other possible defects in the experiment could have been due to the way the sample was diluted, allowing for contamination, which is an issue of concern which may not have had enough time to mix before the analysis was taken. Further experimentation will be needed with a far more pure sample of HFO-1234ze, as well allowing time for the samples to mix well in the dilutions in future experiments we will be able to compare and contrast the data sets with results gained from this experiment.

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