The Ultimate Fate of Perfluoroamines in the Atmosphere

Mutwiri, Peace

After the ban of hydrofluorocarbons by the Kigali Accord, humans turned to perfluoroamines as potential substitutes. However, little information is known about these compounds. This work analyzes a perfluoroamine compound, CF3(CH2)2(CO)NH(CH2)N(CF3)2, to understand its chemical properties, environmental impact, and global warming potential (GWP). I hypothesize that this perfluoroamine molecule poses a threat to the environment because the compound will have IR frequencies fall in the Earth's atmospheric window. The compound also possesses strong CF bonds that are less likely to be broken by hydroxyl radicals in the atmosphere, leading to longer atmospheric lifetimes. This combined long lifetime with a large radiative forcing value may lead to global climate change. An input file describing the compound's atoms and bond lengths in relation to one another was created and optimized with the Gaussian 98 program. Output files that detailed the compound's chemical properties were analyzed with an Excel spreadsheet and the compound's radiative forcing value and global warming potential were calculated. This perfluoroamine has a radiative forcing value of 0.72 W 1/m^2 per area per part per billion of concentration. Meanwhile, Pinnock's work shows that HFC-134a, banned by the Kigali Accord, has a value of 0.167 W 1/m^2 1/ppbv. Because hydrofluorocarbons have already been banned by the Kigali Accord, and the perfluoroamine compound's radiative forcing value exceeds that of the hydrofluorocarbon, it is clear that if the perfluoroamine was released into Earth's atmosphere, it would absorb large amounts of infrared radiation and lead to increased levels of global warming.