Sulfur Dioxide-Halide Ion Complexes: A Crystallographic Investigation of Bonding

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Sulfur dioxide (SO_2) is a major air pollutant, and SO_2 emissions result in both acid rain and atmospheric particulates. Little attention has been paid to a relatively simple method for reversibly binding SO_2, a method which could potentially be used to remove it from waste streams. There is only one example of an "$[SO_2Cl]^-$" anion currently identified in the Cambridge Structural Database (April 2018). The number of "$[SO_2\ldots Cl]^-$" adducts described is also few (less than 10) and the criteria for bonding in such adducts has not been well described. The reaction of SO_2 gas and halide salts was thus used to generate a series of halosulfite (SO_2X^-, X = Cl, Br, I) compounds. The structures of the solid compounds obtained, three tetraphenylphosphonium complexes, $[PPh_4][SO_2X]$, and [IMesH][SO_2Cl] (IMesH = 1,3-*bis*(2,4,6-trimethylphenyl)-imidazolium), were determined using X-ray crystallography. Preliminary investigations suggest that these same products can also be formed *via* solvent-free, solid-gas reactions. It was found that the complexes readily released SO_2 when heated, suggesting that they should be candidates for SO_2 capture.