reaction velocities by orders of magnitude over the auto-oxidation rate, while similar trace quantities of organics inhibit the rate. The characteristics of the chemical reactor govern the range of the half-life that can be investigated and may influence the observed rate of oxidation. Two-phase air-water reactors (e.g., bubblers and supported droplets) may have reaction characteristics that are dependent upon: (1) the mass transfer rate of the reactants through the air-water interface, and (2) the mixing rates within the gas and water phases (Carberry, 1976; Freiberg and Schwartz, 1981). Unless an adequate characterization of the two-phase reactor was performed, it is not recommended that the implied elementary rate constant be accepted. Supported droplets may suffer from an additional problem: radical chains are efficiently terminated at liquid-solid interfaces, thereby reducing the observed rate. Therefore, supported droplet measurements are not defensible unless it is established that the oxidation is not a free-radical mechanism. Notable reviews of the oxidation of dissolved SO_2 and its hydration products in simple systems have been published (Schroeter, 1963; Hegg and Hobbs, 1978).

This review will show that:

1. The auto-oxidation (uncatalyzed) reaction is very slow compared to the other reactions.
2. Mn(II) and Fe(III) are significant catalysts for the oxidation. The kinetic rate expression is in doubt for the Mn(II) reaction, but that for Fe(III) is in agreement among several independent investigators.
3. The catalytic effectiveness of these ions is unknown: Cu(II), V(V), V(IV), Ni(II), Zn(II), and Pb(II).
4. Elemental carbon (soot) with a water film is a potentially effective oxidation catalyst.
5. Dissolved HNO_2 and O_3 oxidation rates are known and appear to be too low to be effective.
6. The kinetics of the dissolved H_2O_2 oxidation of dissolved SO_2 species are known and appear to be effective for forming sulfate in particles, mists, fogs and rain.