CHAPTER V, PART A: Ethane Formation from Chloroplasts Exposed to SO_2 - A Measure of Lipid Peroxidation

1. Introduction

Sulfur dioxide is a major air pollutant causing damage to plants. The increasing demand for the use of coal for power generation may lead to an increase in SO_2 pollution (Rubin, 1981). Various physiological parameters are affected in plants exposed to SO_2. These include inhibition of photosynthesis and growth rate which can occur without visible injury (Hallgren, 1978). One of the first ultrastructural changes observed in plants exposed to SO_2 is damage to chloroplast membranes (Fischer et al., 1973; Hallgren, 1978; Wellburn et al., 1972), resulting in a loss of membrane integrity, which is vital to all processes in the plant. Proteins are susceptible to attack by sulfite (Schroeter, 1966) which would lead to altered membrane structure and function. Recent work from our laboratory (Lizada and Yang, 1981) has shown that sulfite can induce the *in vitro* peroxidation of linoleic and linolenic acid which could lead to the alteration of membranes. Inasmuch as these two fatty acids comprise approximately 75% of those found in chloroplast membranes, peroxidation of these fatty acids may be an important factor contributing to damage *in vivo*.

Sulfite can undergo very rapid oxidation to sulfate through a free radical mechanism which predominates at low concentrations (Abel, 1951; Schroeter, 1966). Free radicals produced during the oxidation of sulfite have been reported to affect the *in vitro* destruction of methionine and tryptophan (Yang, 1970; Yang, 1973) indole-3-acetic acid (Yang and Saleh, 1973), chlorophyll (Peiser and Yang, 1977), β-carotene (Peiser and Yang, 1979), and oxidized NADH and NADPH (Tuazon and Johnson, 1977). Also the peroxidation of linolenic and linoleic acids has been attributed to free radicals produced during sulfite oxidation (Lizada and Yang, 1981).

Because chloroplasts are rich in linoleic and linolenic acid and appear to be an early site of damage by SO_2, we have studied whether sulfite could induce lipid peroxidation in chloroplasts via free radical mechanisms.