

Free radicals of the pine needles as an indicator of damage to forests caused by car exhaust gases

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Electron Spin Resonance (ESR) spectra have been recorded from needles of pines growing deep in a forest, far from municipal areas, and of pines growing in the vicinity of roads with heavy traffic. An analysis of the spectra has revealed that pine needles may serve as a sensitive indicator of damage to forests caused by chemical pollutants (car exhaust gases). Two effects have been observed: (1) loss of manganese ions and (2) in vitro detection of a weak signal from the ascorbyl radical, indicating loss (utilization) of vitamin C in vivo (defense reaction of needles to oxidative stress). A new method (preliminary paper) is presented which makes it possible to perform such studies using an ESR spectrometer with a relatively low sensitivity, making the method of accumulated spectra obsolete.