BRIEF PAPERS

EFFECT OF HIGH FREQUENCY SOUND WAVES ON OXIDASE ACTIVITY

(WITH ONE FIGURE)

During the last few years numerous papers have appeared dealing with the chemical and biological effects of high frequency sound radiation. In the present investigation its effects on the activity of oxidase have been determined.

The apparatus producing high frequency sound radiation was similar to that used by Harvey, Harvey, and Loomis (2). The waves were produced by a quartz crystal measuring 2.5 cm. square and ground to give a natural frequency of 450,000 cycles. It was immersed in an oil bath, supplied with an adequate cooling system. This crystal was energized by means of a step-up air transformer, the primary of which was the tank coil of an oscillating Hartley circuit. The plate of the 75-watt tube was supplied with a 60-cycle unrectified current at a voltage of 3500 (r.m.s.).

Fruit extracts were prepared from apricots, peaches, and avocados. The fruit was frozen, ground, dispersed in a large volume of water, and filtered. The oxidase activity of these extracts as measured by the rate of oxygen absorption in the presence of catechol was similar to that of oxidase preparations obtained by the alcohol precipitation method.

Five cc. of the extract were introduced into a thin-walled bulb, which was suspended in the oil bath so that its bottom was about 5 mm. above the crystal. Samples were withdrawn from time to time and their oxidase activity determined by means of a Warburg respiration apparatus (3). The rate of oxygen absorption at 25°C. was measured, using an acetate buffer of pH 4.9 in the presence of 1.5 per cent. of catechol as substrate.

In all cases exposure to the sound waves resulted in a considerable decrease of oxidase activity. No complete inactivation was obtained in treatments up to 12 hours. When the time of exposure was plotted against oxidase activity, all curves approached a logarithmic form; however, the data were not strictly reproducible with the equipment used. A typical curve is shown in figure 1.

In order to correct for effect of temperature, controls were incubated at 38°C., the highest temperature observed in the exposed tube. As shown in the figure, the decrease in activity at this temperature was negligible in comparison with that produced by high frequency sound waves.

The action of sound waves has been frequently ascribed to oxidative processes. It was found, however, that washing out most of the air with
Fig. 1. Effect of high frequency radiation on oxidase activity of avocado extract under nitrogen.

hydrogen or nitrogen by bubbling the gas through the solution before treatment, and also by continuing the washing during the treatment, produced no significant differences in the effect of irradiation.

Since recently Beuthe (1) has attributed the effect of high frequency sound waves to the formation of hydrogen peroxide, the amount of H$_2$O$_2$ formed during irradiation of distilled water was measured by iodine titration. When 100 times this concentration of H$_2$O$_2$ was added to the fruit extract, its oxidase activity was not affected appreciably.

It is seen that high frequency sound waves progressively destroy oxidase activity. It would appear that oxidation played a minor rôle in this destruction.—Ralph J. Christensen and Rudolf Samisch, Fruit Products Laboratory, University of California.

LITERATURE CITED