THE EXCESS RADIOACTIVITY OF TRYPSIN MIXTURES

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ABSTRACT The radioactivities of mixtures of trypsin and HB_3O_3 or LiCl have been measured and compared with the radioactivity of the constituents. No evidence was found for the production of heavy particles, as had been previously reported, neither were the excess counting rates of the mixtures over that of its constituents as large. The residual excess radioactivity was about four orders of magnitude smaller than that published, yet was still statistically significant, consisting mainly of electrons having a maximum energy less than about 400 keV. The excess radioactivity of a mixture of trypsin and LiCl had a probable half-life between 5 and 46 days. Possible mechanisms for these excesses are discussed.

Results have been published on the production of nuclear particles from mixtures whose constituents, the enzyme trypsin and H_3BO_3 or LiCl or $BeCl_2$, were each separately stable (Wszolek et al., 1970). This was interpreted as a chemically induced perturbation of the nuclear levels by the rearrangement of the π electron configuration in the enzyme molecular structure (Konaski et al., 1969). It would thus appear that chemical changes, of the order of, at the most, tens of electron volts, could trigger the emission of particles having energies of the order of tens or more kiloelectron volts. These results seemed so unexpected that we decided to repeat the experiment with different detectors.

Two different low level counters were used, both were sensitive to electrons, alphas and gammas above a threshold of about 50 keV. The trypsin, boric acid, and other samples were in powder form. Following the proportions of Wszolek et al. we mixed 10 parts of trypsin or LiCl to 1 part of boric acid in 2 cm^3 of distilled water; the mixture was then spread onto the sample holder and dried with a current of warm air.

The mixtures always had an appreciable excess of radioactivity over the activity of its constituents, of the order of 0.2–4 pCi/g of trypsin. From absorption measurements the radiation appeared to consist of electrons having a maximum energy between 150 and 400 keV, and possibly gammas. The resolution of our counters and the stability of a multichannel analyzer over a week or so were insufficient to permit

a precise pulse height analysis: the excess radiation from a mixture of LiCl and H_3BO_3 had a decay half-life between 5 and 46 days.

The activity of the mixtures was strongly correlated with the duration of the drying process in their preparation. The most probable explanation of this effect is adsorption of radioactive fallout contamination from the air during the drying time. A possible candidate for the adsorber contaminant is ^{131}I. The natural radioactive compounds in the air from the radium and thorium series were not detected.

The exact mechanism of this selective adsorbtion is not clear; further tests, such as with the pH values, surface structure, and other biological compounds, under closely controlled conditions of preparation, are necessary before any clear conclusions can be reached. The ability of moist trypsin compounds to adsorb iodine selectively may be of importance for monitoring very weak radioactive sources or for certain biological processes.

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A fuller report of this work is available on request from the authors.

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