SELECTIVE DECOMPOSITION OF EITHER ENANTIOMER OR ASPARTIC ACID IRRADIATED WITH $^{60}$Co-$\gamma$-RAYS IN THE MIXED AQUEOUS SOLUTION WITH D- OR L-ALANINE

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Abstract. Aqueous solutions of various amino acids were irradiated with $^{60}$Co-$\gamma$-rays, and subsequently the remaining amino acids were analyzed using HPLC. The D$_{37}$ for the 1 mM glycine and alanine solutions were $1.95 \times 10^4$ and $1.48 \times 10^4$ Gy, respectively. However, when the mixed solutions of glycine and alanine (each in 0.5 mM) were irradiated under the identical condition, the D$_{37}$ for the glycine decomposition increased to $3.56 \times 10^4$ Gy, while that for alanine decreased to $0.65 \times 10^4$ Gy. A similar phenomenon was observed also in the case of the mixed solutions of aspartic acid and alanine. Namely, aspartic acid was protected from the attack of radiation by the presence of alanine in the solutions. The most interesting finding in this combination experiment is that, when D,L-aspartic acid was irradiated in the presence of L-alanine, the radiation-sensitivity of L-aspartic acid decreased selectively and vice versa. Namely, the asymmetric field induced in the solutions by adding D- or L-alanine might affect the radiodecomposition rate of either aspartic acid. Addition of glycine to D,L-aspartic acid did not bring about the asymmetric decomposition. It seems that some interaction between these amino acid molecules resulted in this effect.

1. Introduction

Recently, a number of evidences suggesting the presence of some interaction, hydrophilic or hydrophobic, between amino acids in aqueous solution have been proposed. For example, lysine and cysteine are directly involved in the aggregation between ovalbumin and lysozyme; the aggregation is partially due to electrostatic attraction (Matsuda et al., 1986). It has been established that proline stabilizes solute proteins during freezing by interacting with them (Rudolf and Crowe, 1986). Tyrosine can interact with other amino acids in bovine-lactalbumin (Dael et al., 1987). Interaction between pairs of amino acids influence the structure and association of proteins (Robillard and Blaauw, 1987). More recently, Cherhati and Szogyi studied the dependence of the lipophilicity of tryptophan on the concentration of other amino acids using charge-transfer reversed-phase thinlayer chromatography, and demonstrated that arginine, asparagine, glutamine, methionine, phenylalanine and threonine interacted with tryptophan, while alanine, glycine and serine showed no interaction (Cherhati and Szogyi, 1988). This finding clearly suggested the presence of hydrophilic and hydrophobic bonding forces between amino acids in aqueous solution which lead to a complex formation.

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The present paper is dealing with the interaction between amino acids as demonstrated by their selective decomposition after irradiation in the mixed aqueous solution. A preliminary report of some of these findings has already been published (Akaboshi et al., 1988).

2. Experimental

The amino acids used in these experiments were obtained from the Takara Kohsan Corporation. They were used without further purification. Usually 1 mM solutions of these amino acids were sealed aerobically in polyethylene screw-cap bottles and were irradiated in a cobalt-60 source at $2.4 \times 10^4$ Gy/hr. Solutions were prepared in milipore-filtered distilled water (1 mL) and irradiation was carried out at room temperature. Each solution was adjusted to pH 6.0 prior to its irradiation. Destruction of free amino acids was measured by determining the amount of amino acids remaining after irradiation. For this purpose, the high performance liquid chro-

![Figure 1](image_url)

**Fig. 1.** HPLC-analysis indicating the selective decomposition of alanine in the glycine-alanine mixed solutions after exposed to various doses of $^{60}$Co-$\gamma$-rays.