

**CHARACTERIZATION OF FAST HEAVY ION
INDUCED PHOTON EMISSION FROM
L-AMINO ACIDS**

By

A. M. Srimalie Manorie Nugegoda

**This thesis is submitted in fulfillment of the requirement for the
degree of MASTER OF PHILOSOPHY of the
UNIVERSITY OF COLOMBO, SRI LANKA.**

504999

2001

Abstract

The research work led to this thesis was based on characterization of fast heavy ion induced photon emission from L-amino acids. A home-built ^{252}Cf Plasma desorption mass spectrometer equipped with a photomultiplier tube, at the department of Physics of the Colombo University was employed to observe the light emission resulted from impact of fast heavy ions on organic and some inorganic targets.

Emission of photons is one of the energy relaxation processes of electronically excited atoms, molecules or crystal lattices. Desorption of molecules and their fragments as well as emission of photons can be observed upon the impact of fast heavy ions on solid surfaces.

In this research work, characteristics of fast heavy ion induced photon emission from L-amino acids numbering 19 were investigated in the 185-680 nm wavelength region and the emissions were found to be mainly confined to the UV region with varying intensities. The so called time-of-flight technique employed in the mass spectrometer was adopted to record the time profiles of the photon emission. This study was extended to obtain the correlation of the luminescence from constituent amino acids on the photon emission from some di-peptides.

The characteristics of fast heavy ions induced emissions from amino acids were compared with the fast heavy ions induced emissions from well-known organic scintillator of anthracene and inorganic scintillators namely CsI and CsBr. The samples were prepared by using droplet-drying method which gave solid crystalline sample surfaces.

Among the amino acids tested the aromatic amino acids namely tryptophan and phenylalanine produced highest photon intensities. It has been found that the photon intensity from tryptophan is comparable with the photon intensities emitted from the anthracene, CsI and CsBr. The wavelength distributions of the photon emission from tryptophan and CsI also showed similar pattern and their maximum emission was found to be in the (300-400) nm wavelength region.

Studies revealed that the decays of ion induced fluorescence from all the amino acids are fast, and possess decay times in the nano second region. Except phenylalanine which has comparatively slow decay components (3.6 ± 0.1 ns and 25.6 ± 0.2 ns), all the other amino acids have at least one decay time less than 3 ns. The investigations also revealed that the decay of the photon emission from inorganic compounds of CsI, and CsBr are a little faster than those of the amino acids of tryptophan and phenylalanine.

The absorption and emission spectra due to the impact of UV photons, on amino acids and di-peptides in liquid phase were also recorded by using UV/Vis Spectrometer (Jas. Co- Model 7800) and a Spectrofluorometer (RF- 5000, SHIMADZU).

The patterns of the wavelength distributions for amino acids of tryptophan and tyrosine were similar when in solid form and excited by MeV fission fragments or in liquid form and excited by UV radiation; in both cases most of the intensity of emission is confined to the 300-400 nm region.

Wavelength and decay time studies done with the di-peptides of trp-phe and tyr-leu strongly suggested that their emission is determined by the more fluorescent constituent amino acid.

Since the crystals of the amino acid, tryptophan can easily be formed, and it is highly stable in high vacuum, it has a high potential as a good organic scintillator.