# The Effect of Viscosity on the Fluorescence Emissions of Phenylalanine, Tyrosine, and Tryptophan

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***Abstract*— Phenylalanine, tyrosine, and tryptophan are essential amino acids that are vital components of virtually all molecular biological processes. To test the influence of viscosity on amino acids through experiments, fluorescence emissions of different glycerol concentrations with three different amino acids were gathered. If higher concentrations of glycerol are interacted with amino acids, then those solutions will emit a greater intensity than those of lower concentrations because the vicious solution will cause the amino acids to become futile. At higher viscosity, the molecule was strongly fluorescent. At low viscosity, conversely, the excited state was rapidly depopulated, supporting the hypothesis of the experiment.**

## I. Introduction

Phenylalanine is an essential amino acid, a bulding block for proteins that the body requires, but cannot create it (2). The body changes phenylalanine into tyrosine, one of the most important amino acid, which is needed to make proteins, brain chemicals, and thyroid hormones. Tyrosine is an amino acid that is synthesized by the body and also acquired from sources of dietary protein (1). Likewise, tryptophan plays a significant role in the human body as precursor for the synthesis of the neurotransmitters serotonin and tryptamine (3). In short, these amino acids are vital components of virtually all molecular biological processes. Phenylalanine, tyrosine, and tryptophan reach the cells through the blood, so the viscosity of blood should therefore impact the efficency of the amino acids. Viscosity is defined as the measure of a fluid's resistance to flow (6). Fluorescence spectroscopy can be used to measure the concentration of a compound since the fluorescence intensity is linearly proportional to the concentration of the fluorescent molecule (8). Fluorescence is caused by absorption of photons in the singlet ground state promoted to a singlet excited state and can be used to examine the interactions at an atomic level (4). To test the influence of viscosity on amino acids, fluorescence emissions of different concentrations with three different amino acids were gathered.

## II. Materials and Methods

Four 10 mL volumetric flasks, distilled water, a 1000 µL Gilson Pipette, Phenylalanine, Tyrosine, Tryptophan, a 1000 µL Gilson Pipette, sixteen 1 mL eppendorfs, disposable pipettes, two cuvettes, a Jasco V-650 Spectrophotometer, a FluoroMax-4 Machine were used.

Glycerol solutions with concentrations of 0.5, 1.0, 1.5, and 2.0 were produced by adding glycerol, along with distilled water, into a 10 mL volumetric flask. Prior to the experiment, calculations were done to determine the amount of glycerol needed in each solution with the density (1.26 g/mol) and molar mass (92.09 g/mol) of glycerol. Using a Gilson Pipette, the amount of glycerol was extracted and placed in a volumetric flask. After, the flask was filled to the 10 mL line with distilled water and shaken for one minute.

To test the interaction of phenylalanine with glycerol, 1 mg of the amino acid was added along with 1mL of each Glycerol concentration into an eppendorf. In order to use the FluoroMax-4 Machine, the wavelength of the amino acid was needed. The cuvettes were filled with one of the original glycerol solution and the other was filled with its corresponding mixture of glycerol and amino acid. Both samples were then placed in the Jasco V-650 Spectrophotometer and the whole procedure was repeated twice for the other two amino acids.

Next, the wavelength of Phenylalanine was put into the range of the FluoroMax-4 machine. The cuvette was filled with the 0.5 M and the other cuvette was filled with its mixture of glycerol and amino acid. The original solution, known as the blank, was placed into the machine and run to obtain the results. Similarly, the mixture was placed into the machine and run. After, the results of the blank solution were then subtracted from the results of the mixture. The whole procedure was repeated with tyrosine and tryptophan with its corresponding wavelength and solutions.

## III. Results

| Wavelength | Fluorescence Emissions | | | |
|---|---|---|---|---|
| 290 | *Phenylalanine* | | | |
| | 0.5 M | 1.0 M | 1.5 M | 2.0 M |
| | 1794970 | 2638440 | 2860720 | 3050690 |
| 300 | *Tyrosine* | | | |
| | 0.5 M | 1.0 M | 1.5 M | 2.0 M |
| | 10737580 | 11097450 | 11011880 | 11478510 |
| 360 | *Tryptophan* | | | |
| | 0.5 M | 1.0 M | 1.5 M | 2.0 M |
| | 466480 | 464210 | 487700 | 555720 |

Figure 1- The highest peak in each Jasco V-650 Spectrophotometer tests was named the wavelength of the amino acid. After the fluorescence emissions were gathered and graphed.

## V. Conclusion

The experiment illustrates a positive correlation between the viscosity of a solution and the intensity of its respective fluorescence emission. The results of the data showed that the fluorescence quantum yields increase in a more viscous solvent according to Fig. 1. However, the intensities of the emissions were not drastic, exemplifying the minute aggregation prevalent in amino acids. These results show that amino acids on their own do not become aggravated but do in a peptide chain. The findings save time by eliminating the need to test the individual amino acids in a provoked peptide, like amyloid beta or hIAPP.

To further the experiment, more trials could have been conducted to validate the results. Moreover, substantial research could be done by testing the effects of viscosity with other aromatic amino acids.

## VI. References

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