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Physical Organic Chemistry

Research Interests

Investigation into the photochemical relationship between the pterin and PABA portions of folic acid

Folic acid is an essential vitamin and is involved in the biosynthesis of various mammalian metabolic pathways. Deficiency of folic acid causes gastro intestinal disorders, loss of appetite, anemia, vitamin B12 deficiency, and premature grey hair. FA is effective in prevention of birth defects of the brain and spinal cord called neural tube defects (NTDs). NTDs happen when a neural tube fails to close properly. Most common NTDs include spina bifida and anencephaly. FA undergoes photo-degradation when exposed to light. Therefore, understanding the photochemical behavior of FA may aid in the preservation of this vitamin in food and food supplements.

Our group performs fluorescence quenching experiments of pterins such as 6-carboxy pterin, 6-methyl pterin, 6-formyl pterin, and 6-hydroxy methyl pterin using various N-methyl anilines and uses Stern Volmer plots for each of the fluorescence quenching experiments to understand the quenching mechanism. The electron donating N-methyl anilines are most efficient in fluorescence quenching. Comparison of Stern Volmer slopes with the Hammett sigma values reveal a probable electron transfer from the N-methyl aniline to pterin resulting in the formation of radical anion and cation of the pterin and N-methyl aniline which would eventually be responsible for photodecomposition of folic acid.

Selected Publications

Martin, C.B., Schmidt, M., Soniat, M.A. "Survey of the Practices, Procedures, and Techniques in Undergraduate Organic Chemistry Teaching Laboratories" *J. Chem Ed.* 2011, 88, 1630-1638.

Soniat, M., Martin, C.B., "Theoretical Study on the Relative Energies of Anionic Pterin Tautomers" *Pteridines*, 2009, 20, 124-128.

Martin, C.B., Walker, D., Soniat, M. "Density functional theory study of possible mechanisms of folic acid photodecomposition" *J. Photochem. and Photobiol. A: Chemistry*, 2009, 208, 1-6.

Soniat, M., Martin, C.B. "Theoretical study on the relative energies of neutral pterin tautomers" *Pteridines*, 2008, 19, 120-124.

Grannas, A.M., Martin, C.B., Chin, Y.-P., Platz, M. "Hydroxyl radical production from irradiated Arctic dissolved organic matter" *Biogeochemistry* 2006, 78, 51-66.

Martin, C.B., Wilfong, E., Ruane, P., Goodrich, R., Platz, M. "An action spectrum of the riboflavin-photosensitized inactivation of lambda phage" *Photochemistry and Photobiology*, 2005, 81, 474-480.

Recent Thesis Topics

Spundana Malla (2011) Theoretical study of the mechanism of photochemical rearrangement of 2,5-diphenyl-3(2H)-furanone"

Tushar Bawale (2009) "The study of photochemical behavior of folic acid in the presence of pterin-6-carboxylic acid, iodide ions, and oxygen using HPLC"

Amit Bhakkad (2009) "Inactivation of E. coli in the presence of folic acid and pterin-6-carboxylic acid as photosensitizers"

Vilas Dalal (2008) "Synthesis of para-substituted N-methyl anilines"

Sridhar Swarna (2008) "Stern-Volmer analysis of the fluorescence quenching of pterins by substituted N-methyl anilines modelling the initial steps of folic acid photo-decomposition"

Prashanth Pabbati (2006) "Investigation into the photochemical relationship between the pterin and PABA portions of folic acid"



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