7. Jährlicher DAbG Workshop



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Effect of Sample Preparation in UV Irradiation Experiments on Potential Molecular Biosignatures

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The possibility of extraterrestrial life has fascinated humanity for centuries. Currently, a number of space research projects are at least partly dedicated to the search for life on other worlds such as Mars and Enceladus. Against this backdrop, terrestrial laboratory experiments simulating extraterrestrial physical and geochemical conditions that might alter molecular traces of life are important. Relevant physical conditions include irradiation by (UV-)light and heat exposure, among others [1]. Should life forms similar to those on Earth exist on other planets and moons, they may rely on biomolecules similar or even identical to the key molecules of life on Earth. A prominent example is amino acids [2], but several other, sometimes less obvious, biomolecules can also be considered here, for example the coenzyme nicotinamide adenine dinucleotide (NAD) and related molecules, which occur in all domains of life on Earth [3].

A common type of experimental studies in biosignature research deals with the stability of biomolecules and their decomposition products under UV irradiation conditions. However, also the effect of different procedures of sample preparation on the to-be-irradiated molecules per se needs to be considered. Procedures for sample preparation include, for example, solution casting, spin coating and sublimation. We will present results on (i) the effect of sample preparation on fundamental properties of amino acids, such as crystal size and crystalline modification [4], and (ii) how different solution casting parameters influence the UV-induced decomposition of 1 methyl¬nicotinamide chloride, a model compound for the redox-active nicotinamide moiety of NAD(P)+.

References

[1] See, for example: Pleyer, H. L., Moeller, R., Fujimori, A., Fox, S., and Strasdeit, H. (2022). Chemical, thermal, and radiation resistance of an iron porphyrin: a model study of biosignature stability. Astrobiology, 22, 776–799.

[2] Cockell, C. S. (2016). The similarity of life across the universe. Mol. Biol. Cell, 27, 1553-1555.

[3] See the accompanying poster "Influence of Mars-Relevant Minerals on the Thermal Stability of the Biomolecule NAD+" by F. Zepf, V. Breckner, B. Haezeleer, A. Engel and H. Strasdeit.

[4] Lörch, D. (2022). The impact of UV-visible light on molecular biosignatures. Master thesis, University of Hohenheim.

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