Geophysical Research Abstracts
Vol. 21, EGU2019-11472, 2019
EGU General Assembly 2019

The search for organic matter on Mars: evolution of nucleobases under Martian simulated environment

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Mars has always been a planet of interest. After several decades of exploration and the discovery of evidence that water may have been present in the liquid state during the first hundred million years of its history, the question of the habitability of this planet is still opened. According to our knowledge about terrestrial Life, it appears that Life is possible only with the presence of organic matter, liquid water and energy sources in order to activate the organic chemistry leading to one or several prebiotic chemistries before any biological activity.

Organic matter on Mars may come from different origins such as an exogenous source (comets, meteorites...) or endogenous source (biological activity, atmospheric production...).
However, only few organic molecules have been detected so far in the Martian regolith (chlorinated, sulphured molecules and methane). Yet, those molecules do not represent at least the exogenous source that is proven to reach the surface of Mars.

One hypothesis is that organic matter evolves in the Martian environment, i.e. strong oxidative reactivity of the Martian regolith, UV radiation, X-rays... In order to understand the evolution of organic matter on the surface of Mars, we developed a setup reproducing some key parameters of Mars. This setup called MOMIE (Martian Organic Matter Irradiation and Evolution) aim to estimate qualitatively and quantitatively the evolution of organic molecules under the physical and chemical conditions of the surface of Mars.

Initially, the MOMIE project consisted to follow the evolution of organic matter under a Mars-like simulated UV radiation. More recently, serious attention is being paid not only on the synergy of these radiations with oxidative compound such as perchlorates that have been detected on Mars, but also on the evolution initiated by other radiation such as X-rays.
The aim is to test some organic molecules supposed to be present on Mars from at least the interplanetary medium. Among them, we choose to study nucleobases such as cytosine and hypoxanthine that have been proven to be UV-light resistant.

The purpose of this work is to determine if those UV-light resistant molecules can resist to the X-rays and to the presence of perchlorate. If not, be able to calculate some kinetics constants and find out potential products of these evolutions. Identifying the products could be useful for future space missions in order to search for those molecules and their degradation products in the Martian regolith. The first results will be presented in the form of a poster.