Nucleic acid bases recovered from Titan tholins and chemical evolutions in Titan liquidosphere

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Abstract : Titan, the largest satellite of Saturn, has a thick atmosphere containing nitrogen and methane. A variety of organic compounds have been detected in the atmosphere, almost likely produced when atmospheric gases are exposed to ultraviolet light, electrons captured by the magnetosphere of Saturn and cosmic rays. The Cassini/ Huygens probe showed that the average temperature on the surface of Titan is 93.7 K, with lakes of liquid ethane and methane. Sub-surface mixtures of liquid ammonia and water will also be present. We have synthesized complex organic compounds (tholins) by exposing a mixture of nitrogen and methane to plasma discharges, and investigated their interactions with several different liquids that simulate Titan's liquidosphere.

In this research, we focused on nucleic acid bases Titan tholins. Nucleic acid bases that terrestrial life has used (Adenine, Cytosine, Thymine and Uracil) already had been found on Titan tholins. Titan tholins were characterized with an UV-HPLC and a LC/MS. As a result, nucleic acid bases of isocytosine and 2, 4-diaminopyrimidine were detected, suggesting that several chemical evolutions might occur in Titan.

On the basis of organic matters such as nucleic acid bases and nitrogen-containing heterocyclic compounds have been already found in Titan tholins, we believed that chemical evolutions could be occurred in Titan's environment.

References: [1] Kawai J., Jagota S., Kaneko T., Obayashi Y., Khare B. N., McKay C. P., Kobayashi K. (2013) Chemical Letters, 42, 635-637. [2] Kawai J., Jagota S., Kaneko T., Obayashi Y., Yoshimura Y., Khare B. N., Deamer D. W., McKay C. P. and Kobayashi K.(2013) International Journal of Astrobiology, 12, 282-291

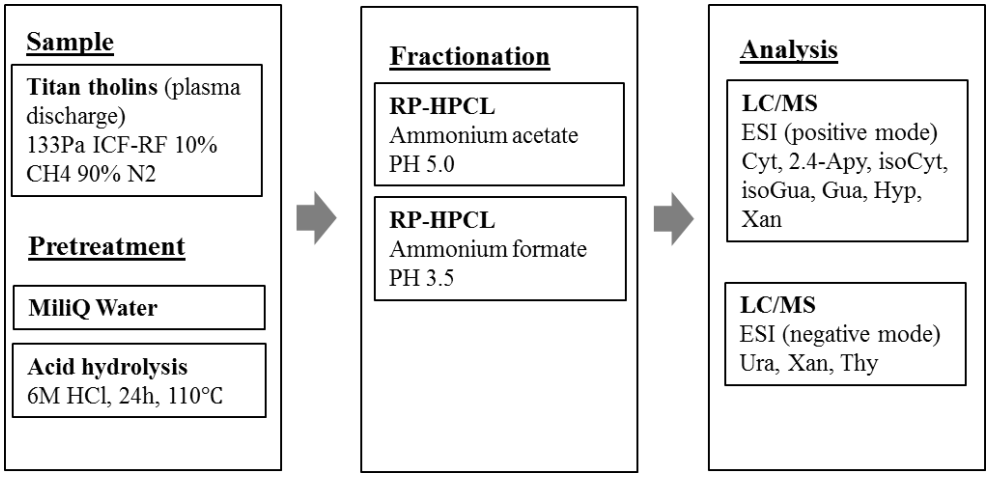

FIG Scheme of this experiment including production of Titan tholins, fractionation with a RF-HPLC and analyzation with LC/MS