



## **Spectroscopic and Visual Evidence of Perchlorate Deliquescence Under Martian Conditions**

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One of the key findings during the Phoenix and Mars Science Laboratory landed Mars missions has been the detection of perchlorate, a highly deliquescent salt. Perchlorates are of great interest on Mars due to their high affinity for water vapour as well as their ability to greatly depress the freezing point of water when in solution. This has intriguing biological implications as resulting brines could potentially provide a habitable environment for living organisms. Additionally, it has been speculated that these salts may play a significant role in influencing the hydrological cycle on Mars. In order to experimentally study water exchange processes between the surface and atmosphere on Mars and assess the feasibility of a future landed detection tool, a stand-off Raman spectroscopy instrument and environmental simulation chamber have been developed at York University. A sample of magnesium perchlorate consistent with the size of patches found at the Phoenix site has been subjected to the low water vapour pressure and temperatures found at polar Martian latitudes. Results indicate that at a water vapour pressure of  $\sim 2$  Pa ( $-54^{\circ}\text{C}$  frost point temperature), Raman spectroscopy is able to detect the onset of brine formation and provide a relative estimate of the quantity of water taken up by the sample until complete deliquescence is reached. Significant uptake of water from the atmosphere is observed to occur prior to the frost point temperature being reached and on time scales relevant to the Martian diurnal cycle. This result suggests that perchlorates in the Martian regolith can contribute to the hydrological cycle, pre-emptively reducing the water vapour pressure before saturation is reached.