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THE PRODUCTION AND DEVELOPMENT OF GEL PROPELLANT FOR IN-SITU LUNAR AND  
MARTIAN TERRESTRIAL OPERATIONS

**Abstract**

This study examines the possibility of utilizing gel propellants for future lunar and Martian missions, taking advantage of the plentiful water ice found on both celestial bodies. Because of their increased performance, safety, and cost-effectiveness, gel propellants have recently attracted interest as a viable substitute for traditional space propulsion systems. The utilization of water ice as a source for in-situ manufacture of gel propellants, in particular, represents a great prospect for future space expeditions. The study focuses on evaluating the efficiency of gel propellants in various simulated lunar and Martian conditions, particularly evaluating their reliability and safety. Data is gathered through a combination of laboratory experiments and numerical simulations to obtain insights into the potential of gel propellants for future missions. The results of the study provide a complete understanding of the benefits and drawbacks of using gel propellants in the harsh environments of the moon and Mars. One of the study's primary findings is that gel propellants have the potential to considerably improve mission independence and reduce the requirement for resupply missions. This has the potential to significantly reduce the cost of space missions while also improving their overall efficiency. The existence of water ice on both the moon and Mars opens up new opportunities for in-situ propellant manufacturing, lowering the number of resources needed for each mission. In conclusion, the results of this study can be a significant contribution to the field of space exploration and has the potential to shape the future of space propulsion and mission planning.

Keywords: Gel Propellant, Water Ice, Propulsion