Safely Solidify Biofuel for Hybrid Rockets

UCF researchers have developed a low-cost and efficient ethanol-based fuel for hybrid rocket engines. Ethanol is a vital renewable fuel for the future, and when derived from sugar cane, can return 8:1 in energy invested in its recovery. Ethanol has a history of success as rocket fuel, though hybrid rockets require a fuel with sufficient yield strength, holding its shape during the acceleration of the rocket burn. The low cost of biofuel based on solidified ethanol, rather than expensive petroleum derivatives, lowers the cost of volume rocket launches, lowers the cost of access to orbit and provides safer sounding rocket flights into space. You can now simply and safely apply the advantages of biofuels to hybrid rockets while cutting costs.

Technical Details
Current methods of solidifying biofuel are cost prohibitive and pose safety concerns. For example, cryogenics could achieve solidification with a very expensive, unsafe, energy intensive fuel preparation process. Alternatively, this new technology creates a stiff plastic out of ethanol to increase yield stress that allows rapid acceleration of rockets. 85% ethanol and 5% water comprise a non-toxic and environmentally-friendly fuel when combined with a gelling agent, primarily methylcellulose. The gel can be further solidified by adding alkali metal acetate. Adding water and a cross linking agent to the compound is optional, for even more yield strength. The mixing occurs for minutes and at ambient conditions, and the fuel is safe to handle before injection of an oxidizer within the hybrid rocket engine. Researchers have chosen components creating exhaust with a high mass percentage of ethanol and low molecular weight, meaning higher exhaust velocity and consequently an increase in thrust. With this new method of production, solid biofuels are now a low-cost fuel option.

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Benefits
- Easily and safely prepared
- Non-toxic
- Environmentally-friendly

Applications
- Hybrid rockets
- Research, sounding rockets

Tech Fields
Aerospace, Biofuels, Clean Technologies

Keywords
aerospace, biofuel, hybrid rocket, solid fuel, sounding rocket, yield stress