Performance of Conventional & Unconventional Hybrid Rocket Fuels

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A hybrid rocket engine uses both a solid fuel and a liquid or gaseous oxidizer. Hybrid rocket engines are generally safer, easier to store, and are simpler to manufacture. They have higher energy densities, cost less, and are more resilient in extreme conditions. This study compared the performance of lard and beeswax fuels to paraffin based conventional fuels. Nine fuel types were cast from conventional and unconventional fuel bases, accelerants, and an additive. The fuels were ignited in the combustion chamber in the rocket while force data was read out on a scale. The force data allowed for the derivation of the net impulse per kilogram (J_net/kg) produced by each fuel. J_net/kg was the value used to quantify efficiency during this investigation. It was observed that when adding the additives to the lard fuel, efficiency increased by roughly 68%. It was also observed that adding the additives to the beeswax fuel decreased efficiency by 83%, but the beeswax fuel was found to be the most efficient over all. Several of the tested fuels were volatile in structure. This limited our ability to test these fuels. The results of this investigation show that unconventional hybrid rocket fuels, specifically beeswax based fuels, have the potential to be utilized as a more efficient hybrid rocket fuel; allowing for more powerful and cheaper hybrid rockets.

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