

IAF SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM (IP)

Author: Mr. Alvaro Bermudez
University of Costa Rica, Costa Rica

DESIGN AND EVALUATION OF A SMALL SCALE LIQUID ROCKET ENGINE USING
PINEAPPLE'S WASTE**Abstract**

Using pineapple's waste for ethanol production, we carry out the design of a small-scale liquid rocket engine. The process involves extracting ethanol from pineapple waste and characterizing the fuel for the design. The small engine of 5.08 cm diameter and 10 cm length utilizes bioethanol as fuel and hydrogen peroxide as an oxidizer, with a design pressure of 150 PSI, an average thrust of 200 N, a chamber temperature of 1600 K and flow exit speed of 1735 m/s. Employing a lower O/F ratio than optimal enables lower chamber temperatures, while facilitating the implementation of a passive cooling system characterized by increased wall thickness. The increase in wall thickness empowers the steel wall to maintain structural integrity effectively. This however lowers the efficiency of the engine at 85.66 % with a specific impulse at sea level of 177 s.

Computational fluid dynamics simulations were conducted using Ansys R1 Student, and comparisons with manual calculations of the engine's performance were made to estimate its behavior before manufacturing processes were undertaken. The results support the feasibility of utilizing agricultural waste for bioenergy production in the aerospace field, emphasizing the potential of this sustainable approach in exploring new sources of energy.