Università degli Studi di Napoli Federico II
Scuola Politecnica e delle Scienze di Base

Space Station Espresso Cup

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Overview

Rather than rely on gravity, the **Space cup** functions in a similar manner to those on Earth, but it uses the combined effects of **surface tension**, **wetting**, and **cup geometry**. The final aim of this project is to simulate both by using a numerical tool and a parabolic flight the raise of the liquid inside of the Space Cup.

Support

Dimensions:
We used as references the dimensions of the cup and the platform.
Tilt:
The support is slightly inclined in order to better visualize the phenomenon.
Material:
Wood is easy to shape, and sturdy.

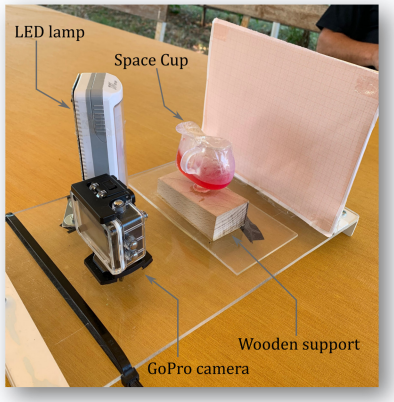


Figure 3: Final set-up adopted

Material Analysis

Type of finish for the resin:
A) Only cured
B) Cured + Ethanol

Liquid used:
- Pure Water
- Solution of water and sodium chloride
- Vegetable Oil

Contact angle and Surface tension:
-To evaluate the best liquid match, the contact angle (CA) and the surface tension (ST) needed to be studied.
-A CAS (Contact Angle System) has been used to measure the CA in different scenarios [Fig. 2].

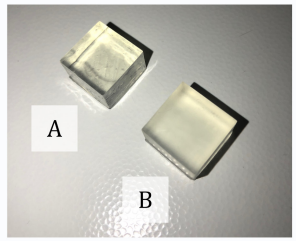


Figure 1: Resin Sample

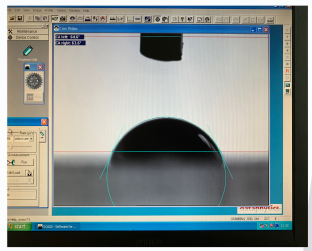
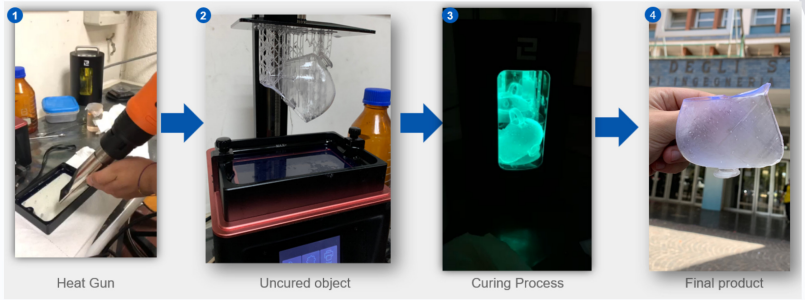


Figure 2: CA measurement

Final Cup



1) The resin was heated to obtain a bubbleless liquid
2) After 25 h, the object was put to air dry
3) During this step, the cup was polymerized
4) We obtained a final product that matched the requirements

Parabolic Flight

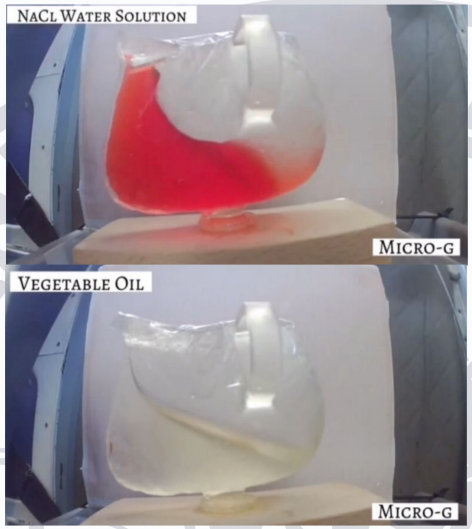


Figure 4: During the parabolic flight we achived micro - g condition. **The water raise was faster than the oil one.**

Fluent Simulation

After assigning all the boundary conditions, the Ansys Fluent 3D simulation proved our predictions. It was possible ot observe than the water raise was faster than the oil one.

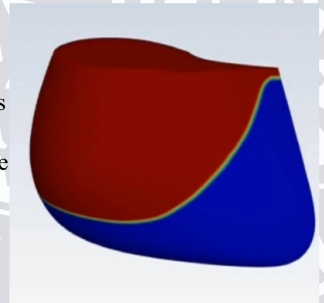


Figure 5: Ex. of the Ansys Fluent (oil scenario)

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