DESIGN CRITERIA & TARGET SPECIFICATIONS

GNG1103, Section # F **Team # F3**

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Updated User Benchmarking

- Tests that provides conclusive data quickly (i.e. under 30 minutes) are more practical to verify a particular stated hypothesis. [1]

Reflections from Client Meeting

The client meeting was an opportunity to develop a proper image of how the design criteria should be. After taking notes throughout the conversation, the team analyzed said notes and developed the following nine client needs to build the project upon. In summary, these needs are to control the rate of erosion through multiple different factors, conduct testing in a manner safe for the machine and its surroundings, and to attain a dependable reading on the factor of erosion. The full list of needs follows this paragraph.

- Control the type of material, the viscosity of the fluid in the system, and the speed of rotation. Does not need to include every factor that affects erosion.
- Spins over 10 rpm, can heat the fluid.
- Construction is done with care and detail; materials can withstand some forces from water, vibrations from motor, etc.
- Testing system should not be pressurized or conducted in elevated temperatures.

- The fluid used for testing erosion should be reasonable, applicable, and safe.
- Testing system should be able to conclude a definitive result, which confirms or denies our theories based on our parameter changes.
- Have at least two parameters influencing erosion be incorporated in the test.
- Drains the remaining water and eroded material into a clean empty container to be analyzed by humans.
- Use the drained water to collect a reading that shows a difference from the initial amount of water in the system.

Requirements

The requirements listed below are sorted into functional (F) and nonfunctional (N).

- Rotates at a variable, controllable speed. (F)
- Change the temperature of the fluid. (F)
- Fluid and debris can be safely drained into a separate container for further analysis. (F)
- Has an emergency stop. (F)
- Well-constructed and will not vibrate apart after sustained operation. (F)
- Portable. (N)
- Easy to set up. (F)

Specifications

The specifications as presented here are not ranked. They will be ranked in the following section.

- Rotates at a speed from 60-100 rpm.
- Heats the water to 40 degrees Celsius.
- Able to operate at around 1 atm = 101, 325 Pascals.
- The dimensions of the specimen are 10 cm in diameter and 5 cm thick.
- Material cost should add up to $100 or less.
- Must be able to run for 2 weeks constantly ± 3 hours.
- Set up time is under 10 minutes.
- Volume of device is 1 m^3 or less.

- Volume of fluid contained is 0.01 m^3 (10 L) or less.
- Power of motor is ≤ 50 V.
- Weight of device is 75 lb or less.

Exhaustive List of Design Criteria

1. Fluid and debris can be safely drained into a separate container for further analysis.
2. The dimensions of the specimen are 10 cm in diameter and 5 cm thick.
3. Rotates at a speed from 60-100 rpm.
4. Heats the water to 40 degrees Celsius.
5. Must be able to run for 2 weeks constantly ± 3 hours.
6. Volume of device is 1 m^3 or less.
7. Operates at around 1 atm = 101, 325 Pascals.
8. Set up time is under 10 minutes.
9. Has an emergency stop mechanism.
10. Material cost should add up to $100 or less.
11. Power of motor is ≤ 50 V.
12. Weight of device is 75 lb or less.
13. Tests materials that will erode in a short period of time; i.e. a 3D printed polymer, a styrofoam, or a light sandstone.
14. Volume of fluid contained is 0.01 m^3 (10 L) or less.

References

[1]

Shesha Jayaram, Edward Cherney, and Luiz Meyer, “Laser Technique for the Evaluation of Erosion Resistance of Insulating Materials | Research.” Accessed: Feb. 04, 2024. [Online]. Available: https://uwaterloo.ca/research/about-research/waterloo-commercialization-office-watco/business-opportunities-industry/laser-technique-evaluation-erosion-resistance-insulating