Deliverable C

Introduction

The purpose of this HALT device is to accelerate the speed of erosion of a 10cm diameter by 5 cm thickness polymer sample as well as to record data from the device that indicates the acceleration of the erosion. Enclose in this document is a list of design criteria, technical benchmarking, and defined target specifications. These elements will aid us in the development of the project with the clients need in mind.

Prioritized design criteria:

HALT DEVICE

Functional requirements for safety of device:

- Temperature cannot exceed 40 degrees Celsius.
- No strong acid/base involved.
- Cannot have sharp edges.
- Dry mass of device cannot exceed 20kg.
- Dry mass of device must exceed 6kg.
- Device is waterproof.
- Device can hold 4L of liquid without damage.

Functional requirements for data collection from device:

- Capable of measuring test duration in hours
- Capable of measuring mass in grams (done manually)
- Capable of measuring volume in ml
- Shows display of time

Time & Money Constrains:

Functional requirements speed of result:

- *Shows results within a month of testing*
- *Have minimal down time (easily repairable)*

Functional requirements for ease of use of device:

- Implementation of stop button.
- *Requires less than 5 steps to install the system*
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Non-Functional:

- *Cost for cannot exceed 105$*
- *System can be set up by one person*
- *System has dimensions of no more than 1*0.5 m*

Ideas

To increase rate of erosion:

- Use of slurry liquid (abrasive/thicker liquid properties means faster gradual destruction)
- Speed at which the slurry liquid is contacting the sample
- Use of cathode/anode (loss of cations in sample due to anode means degradation of sample)

Material

-sandstone

-plastic polymer (for sample)

Possible items needed:

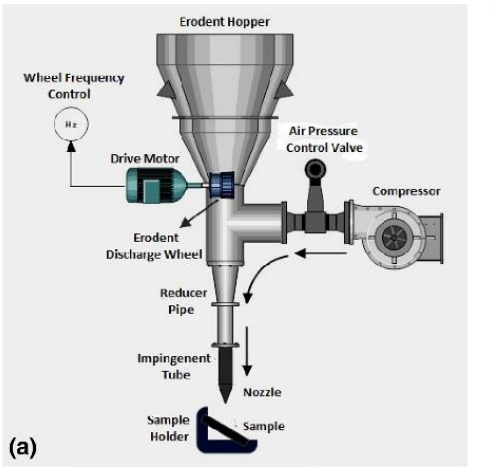
- Slurry pump
- Pipes
- Reservoir tank
- Silica
- Drainage pipe
- Metal Mesh
- Water

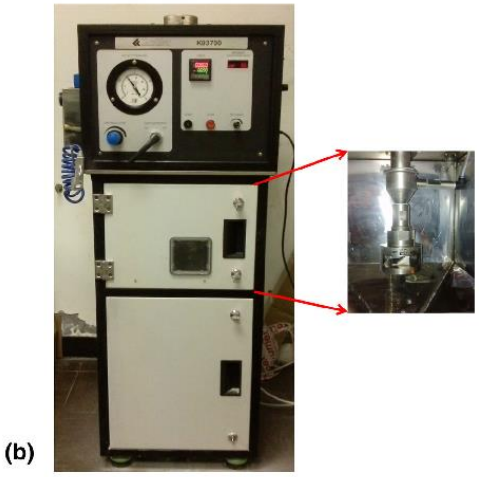
Technical benchmarking

Slurry Pot test

Description	Pros	Cons
The Slurry Pot erosion tester uses a main chamber in it to stir a mix of some sort of minerals (like sand) and water and the slurry mix revolves around the main chamber from the use of a motor on the bottom. Then the sample goes into the slurry chamber in a fixed position so that it takes on the friction of the water and sand molecules thus eroding it. This method measures it the erosion from mass before and after being in the chamber for a certain amount of time.	- Simple to understand build and operate compared to others like the close pipeline rig. - Inexpensive - Easy to find materials for because a cylindrical chamber is easier to come by than things like high pressure pumps like in the jet erosion tester. Or sturdy pipes like the closed loop	- Their can be uneven distributions of sand which can affect erosion on some sides of the sample more than others - If it goes over 1600 rpm then it will make a vortex in it which will erode only the sides of the sample.

Jet Erosion Tester

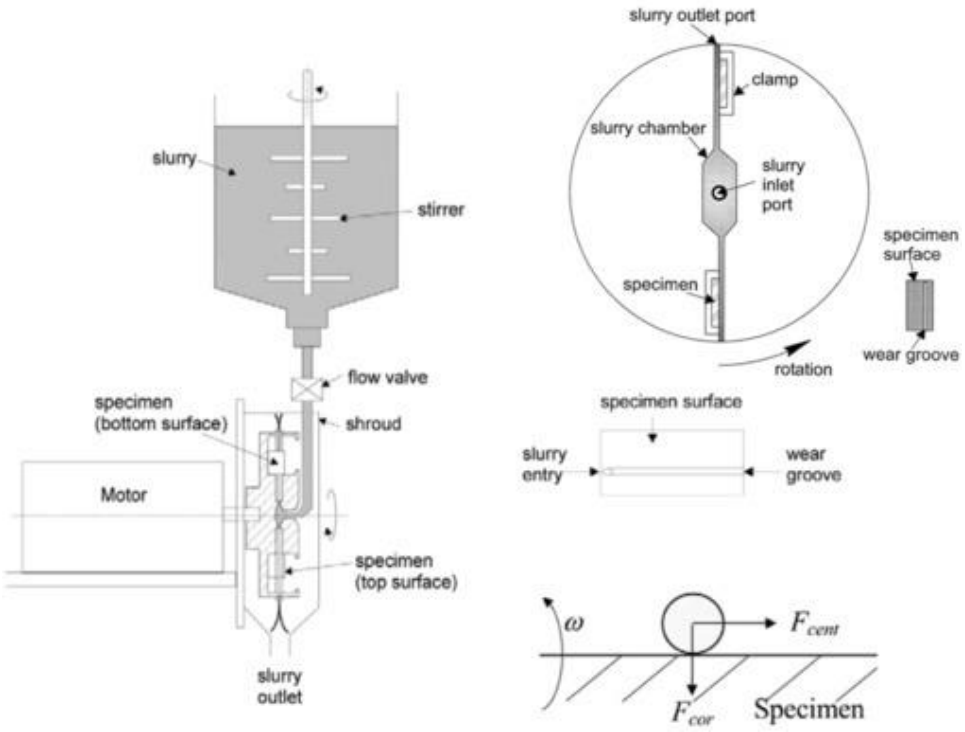




Description	Pros	Cons
It is a machine that uses a very strong pump to squirt water (or a slurry mixture) out of a nozzle onto a rock or sediment sample. This then produces a whole or indent in the material which can be measured to find out how durable the material is against erosion. This method would output more visual results rather than measuring the mass before and afterwards. Because the indent is the point of interest not the difference of mass.	- It is much more consistent than the slurry pot erosion tester - It is fast at testing its samples compared to other erosion testers.	- The nozzle of the machine needs to be changed regularly because it will erode quickly. - The stream of water does not hit the same point on the rock very accurately because of the erosion of the nozzle - High pressure pumps and pipes that can withstand high pressure are expensive - If it is using a slurry mixture it can clot in

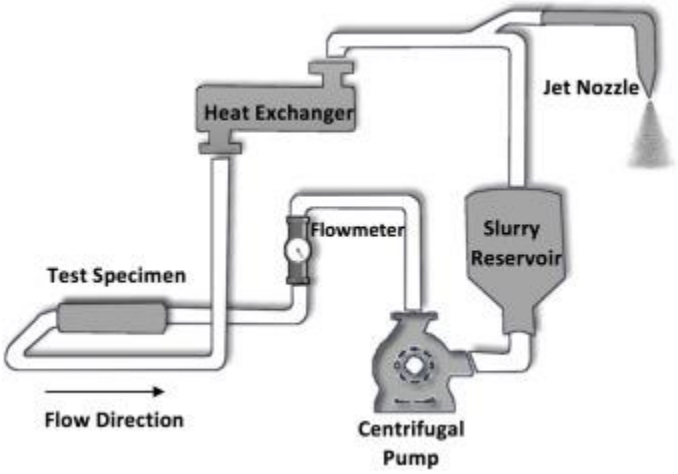
		the nozzle and have a large burst of sand that can cause irregularities in the results. Compared to other designs.

Coriolis Erosion Tester



Description	Pros	Cons
The Coriolis erosion test machine replicates erosion in rotating slurry systems like pumps. It involves a spinning steel rotor with two flat specimens placed in a channel. As the rotor speeds up, centrifugal force pushes slurry outward, and the Coriolis force enhances slurry interaction with the specimens' back wall, simulating erosion conditions in real-world systems.	-Simple and rapid with excellent control of experimental conditions -Good for reproducing the action of slurries moving inside centrifugal pumps and cyclones -Good for ranking erosion resistance of slurry pump components	- Simulating the erosion just under low interaction intensity (Only low impingement angles and low velocities) - Only suitable for flat samples

Closed loop pipeline Rig



Description	Pros	Cons
A closed loop pipeline test rig is a popular test method that is designed to be as close to similar operating conditions as possible. This test system contains 5 components which consists of a heat exchanger, jet nozzle, slurry reservoir, centrifugal slurry pump, and a specimen holder. The centrifugal slurry pump allows for the slurry mixture to flow at different speeds and allows for a different viscosity. The heat exchanger keeps the temperature consistent. The slurry must be replaced periodically due to particle degradation.	- Most realistic test system - Easy to model - Does not use a lot of slurry	- High cost - Takes a long time - High probability of damaging centrifugal pump - Must be cleaned to ensure pipes and pump are clear of stuck slurry mixture.

Reflection on client meeting:

Our expectations for our device changed after the client meeting. This was due to the client wanting something more efficient. But what we did not consider taking into account is that they were also looking for something durable. As the client stated they already made a functioning erosion tester, but it broke due to the system not being durable enough and too slow. So, we expected half of what was said. As for the design in general she mentioned different liquids were allowed which we interoperated as a way of stating water mixtures to be used instead of water. As a result, group Breaking Good decided to use that idea in our design criteria by calling what would have been water we are using to slurry substance. There have been no updated needs for the deliverable B.

References

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