



Team 1

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Introduction

Coloursmith Labs Inc:

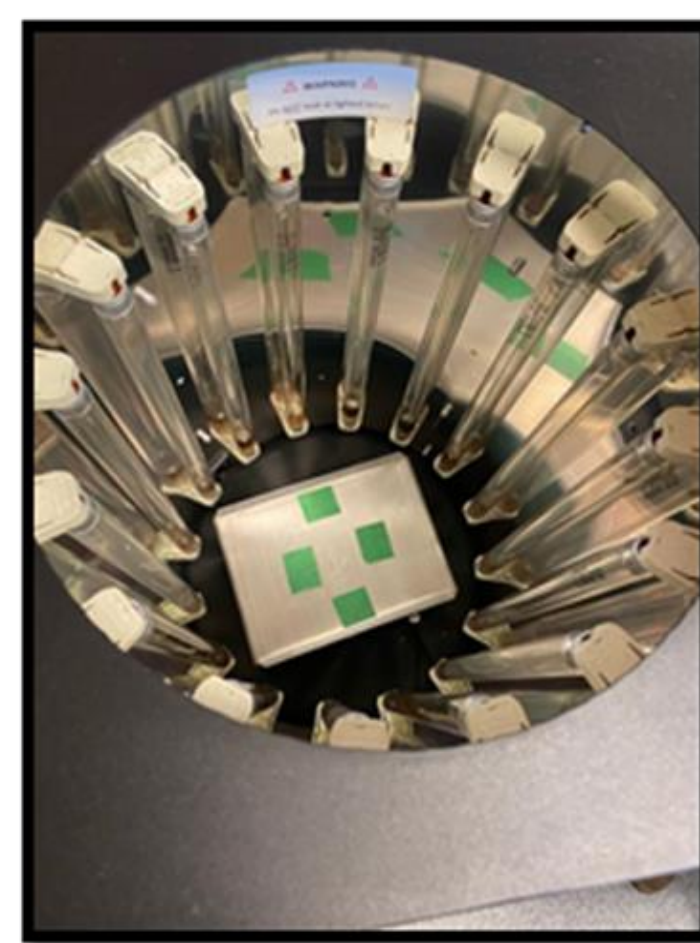
Their goal is to improve contact lens users' quality of vision through optical filtering while ensuring the longevity of individuals' eyesight.

Scope:

Design modifications for the UV reaction chamber to improve the consistency of sample degradation results of equivalent chemical solutions.

Requirements:

- Mechanism Height: < 28 cm
- Mechanism Radius: < 21.7 cm
- Cuvette: 12.4 x 45.0 x 12.4 mm
- Glass Slide: 25.9 x 75.5 x 1.0 mm
- Must hold/stabilize 4 samples in a trial
- Material does not deform below 70°C
- Standard deviation of % change of sample absorbance < 3.0%
- Budget: \$250.00.



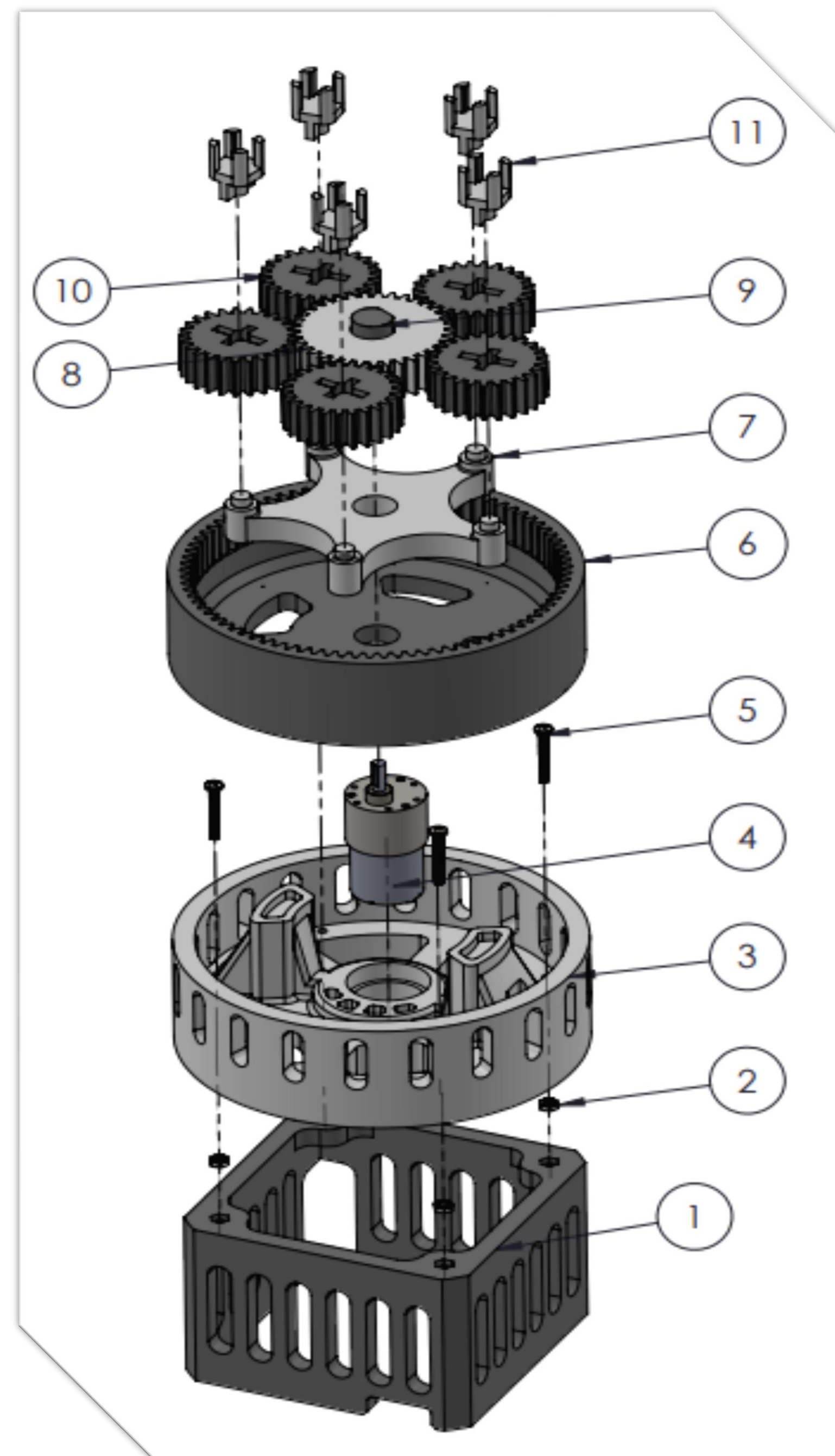
Design Process

- After exploring three different initial design ideas, the group determined that the concept of rotating the UV samples around the reaction chamber would be the most effective.
- The planetary gear train was designed using relevant theory taught in prior MECH courses.

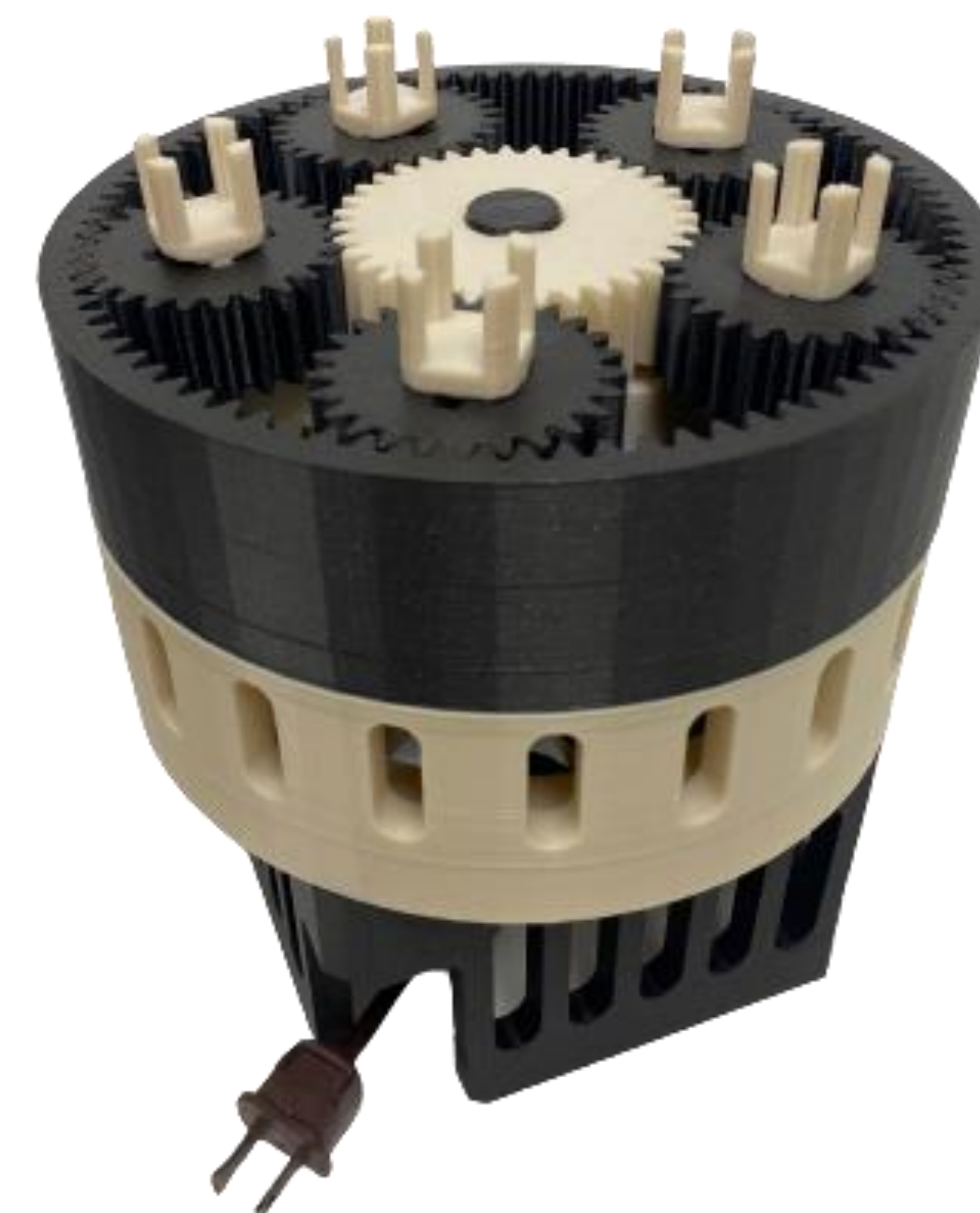
$$S + P = \frac{R + S}{2} \quad \left| \quad \frac{R - S}{\text{NO. PLANETS}} = \text{INTEGER}$$

- Two prototypes were 3D printed prior to fabrication of the final apparatus. PLA and PETG were used for prototyping and ASA was used for the final product.
- The hex nuts were embedded in the base for easier assembly.
- Posts were added to the motor housing to fix the rotation of the ring gear.
- The ring gear and the bed supporting the carrier arm were modified to be a single part.
- The design of the keyed shaft was modified for easier assembly.
- A quieter motor was purchased.

Details of Design

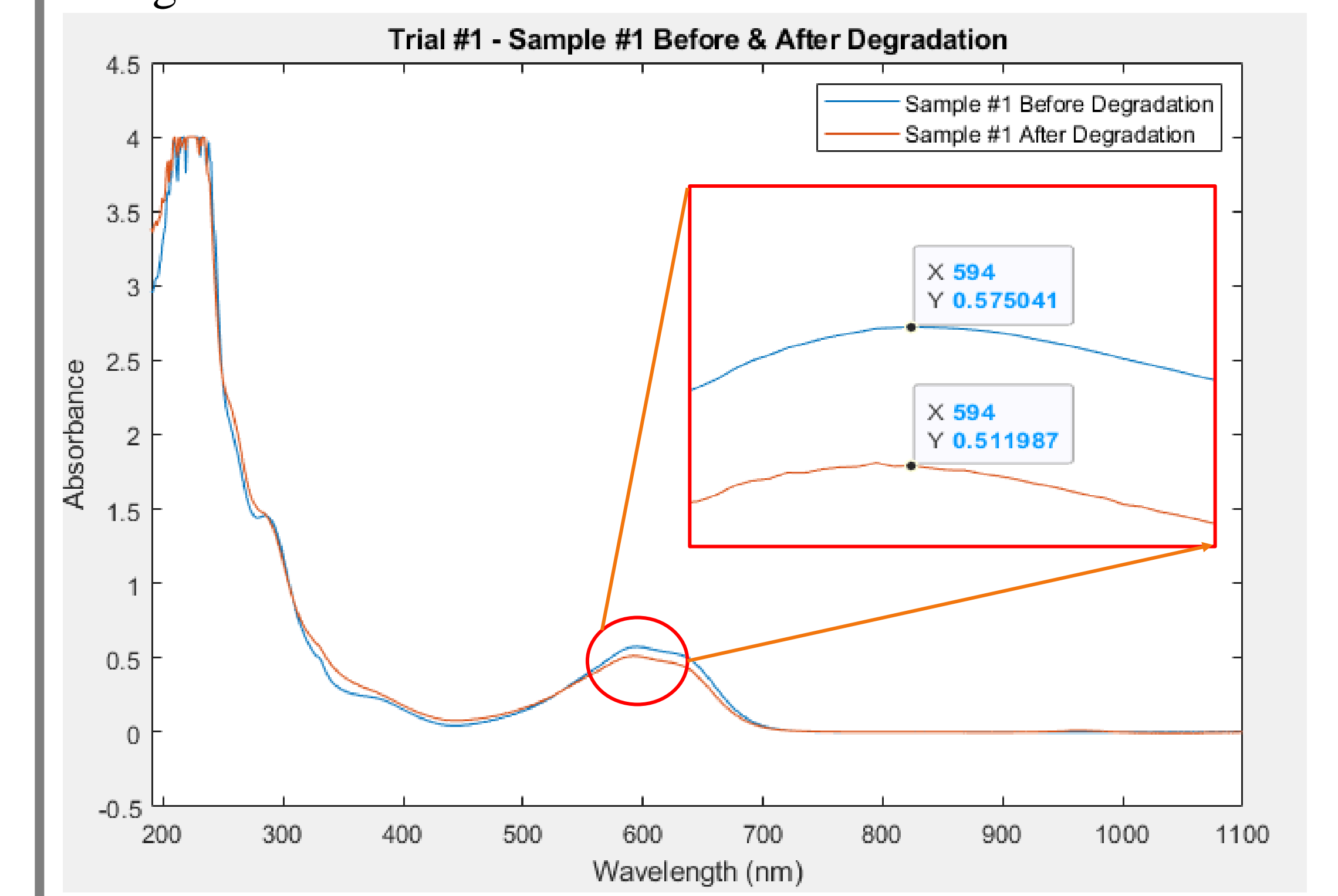


No.	Name
1	Base Component
2	6-32 Hex Nut (x4)
3	Motor Housing
4	Motor
5	6-32 x 1-1/2" Machine Screw (x4)
6	Ring Gear
7	Carrier Arm
8	Sun Gear
9	Shaft
10	Sun Gear (x5)
11	Cuvette Holder (x5)



Lab Testing

- Samples were created by mixing a dye (Remazol Brilliant Blue) with water.
- Absorbance of each sample was measured before and after degradation inside the UV Chamber.
- A UV-Visible Spectrophotometer measured the samples' absorbance at wavelengths between 190 and 1100 nm.
- The absorbance was compared at a wavelength of 594 nm where a peak was observed.
- The figure below represents a sample before and after degradation in trial #1.



Test Results

- In each trial, four samples were tested. The table below represents trial #1.

	Sample 1	Sample 2	Sample 3	Sample 4
Initial Absorbance	0.573551	0.572153	0.575701	0.573975
Final Absorbance	0.510164	0.516834	0.506913	0.512618
Percent Change	11.05	9.67	11.95	10.69

- Three trials were completed, and percent change of absorption was calculated along with the standard deviation. These results are in the table below.

	Trial 1	Trial 2	Trial 3	Combined
% Change - Average	10.84	12.16	11.09	11.36
% Change - St. Dev.	0.94	1.35	1.18	1.21

- All three trials were successful with a standard deviation of % change less than 3%. When all samples were compared, less than 3% was observed as well.
- Final design successfully tests up to 5 cuvettes or glass slides
- Final cost of the apparatus and prototyping was \$238.57 which was under the budget of \$250.00.

Project Status

Accomplished Project

- The final model is printed and assembled and is tested to work successfully.
- The apparatus will be used for samples degradation by Coloursmith researchers and operators.
- A Standard Operation Procedure with assembly and usage instructions is prepared as needed.

Extra Material

- Coloursmith Lab is provided with extra components including cuvette holders and gears for replacements.
- The CAD files of all components are sent to Coloursmith Lab for reprinting if necessary.