



Exploring Laser-Ablated Mesh for Enhanced Oil-Water Separation: Innovations in Environmental Remediation

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01

Overview

Overview

- Thousands of oil spills in US each year
- Coat birds' wings - leave it unable to fly
- Strip insulation of sea otter's fur- risk of hypothermia
- Toxic compounds making up oil can cause health problems (heart damage, stunted growth, immune system effects, death)
- Current clean up methods:
 - Skimmers
 - Burn oil away
 - Chemicals
- Mesh for oil water separation as an environmental solution to oil spills



Photo Credit: NOAA



Photo Credit: NOAA

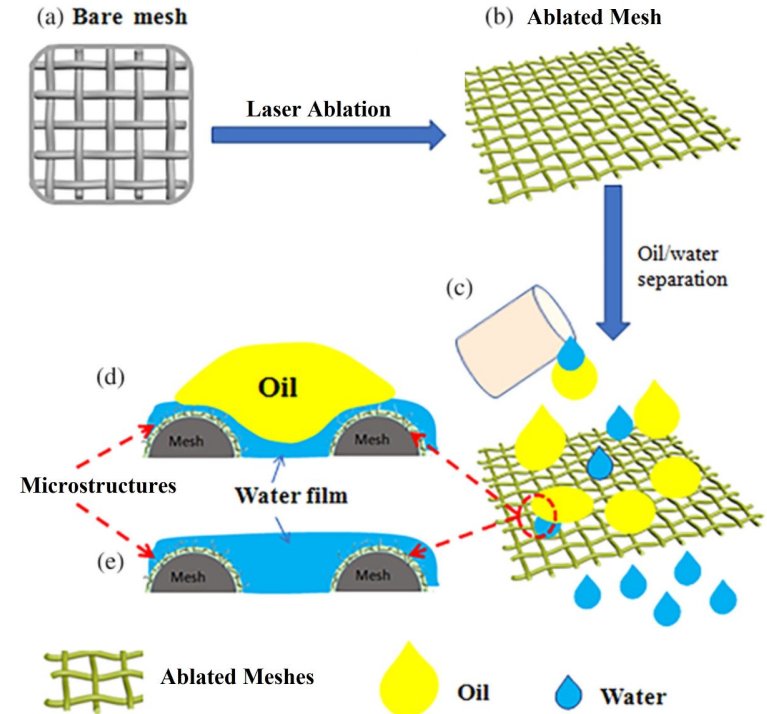


02

Background

Oil Water Separation

- Laser Ablation - remove small amounts of material to create textured surface
- Ablation on mesh creates hydrophilic surface
- Water forms bridges between the gaps in the mesh
- Oil sits on the bridges and can't go through







03

Goals

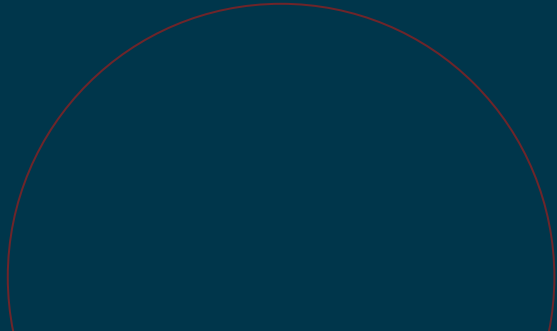


Goals

- Oil water separation as a function of time
- 4 different samples
 - All Copper
 - Different scanning speeds
 - 40/5
 - 20/10
 - 40/10



20/10 (40 micron/ms with 20 micron spacing)
40/10 (80 micron/ms with 20 micron spacing)
20/5 (40 micron/ms with 10 micron spacing)
40/5 (80 micron/ms with 10 micron spacing).





04

Setup

Setup

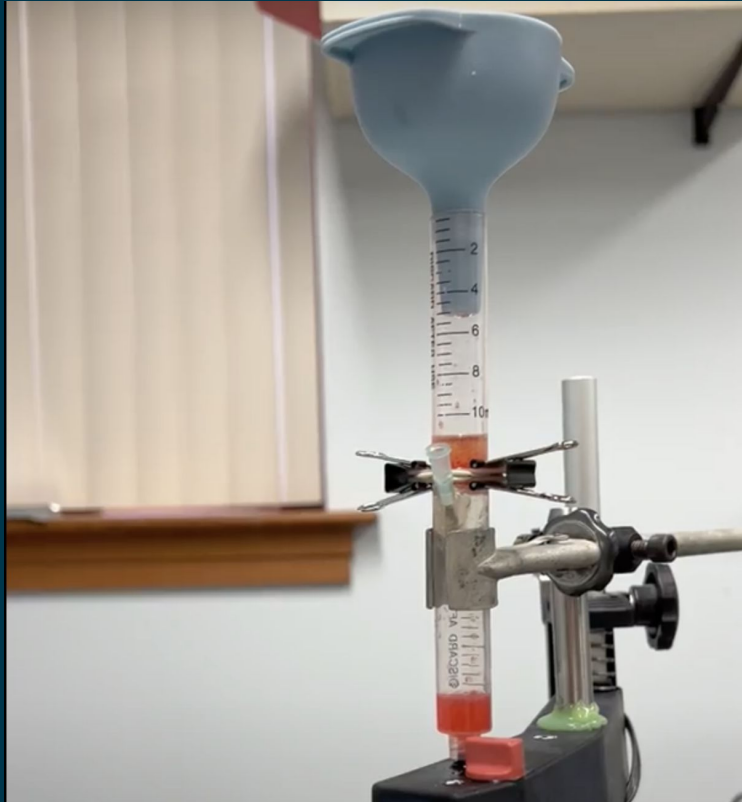
- Fraction Collector
- Syringes
- Ultrasonic Bath
- Mesh Samples



Procedure

Step 1

Prepare sample



Procedure

Step 2

Set Fraction Collector

Step 3

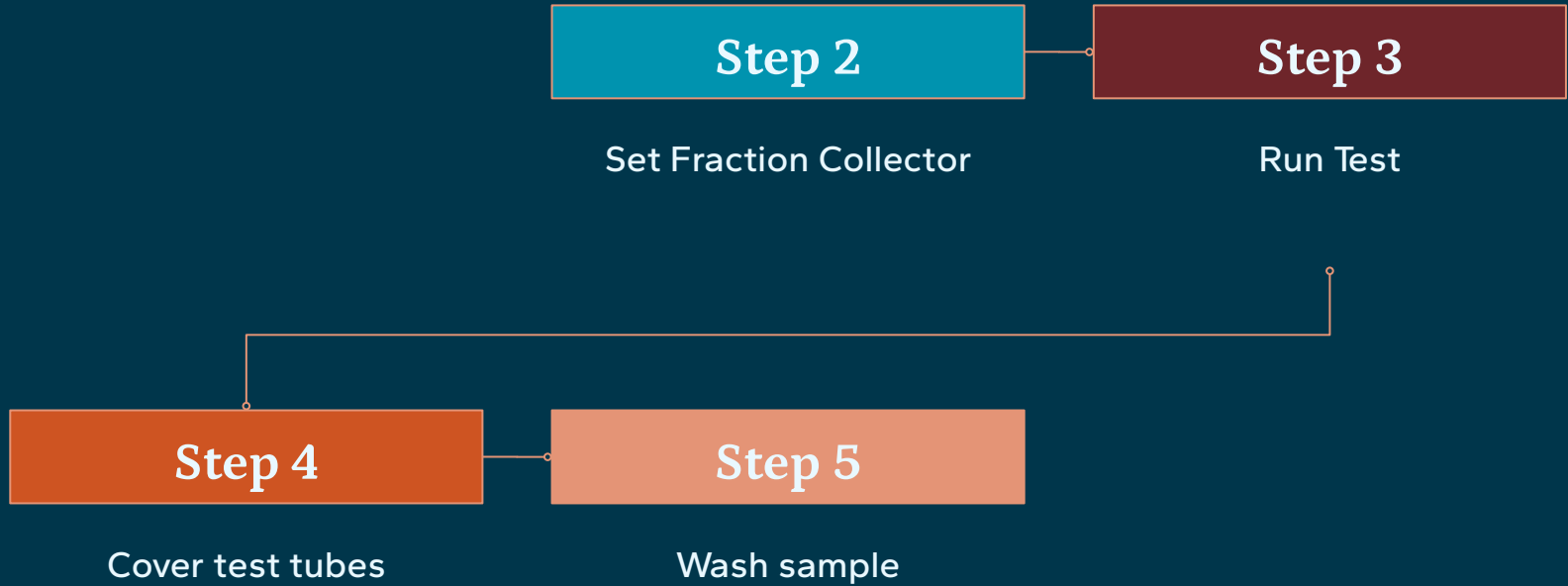
Run Test

Step 4

Cover test tubes

Step 5

Wash sample



Procedure

Step 6

Wait, then
measure/analyze data

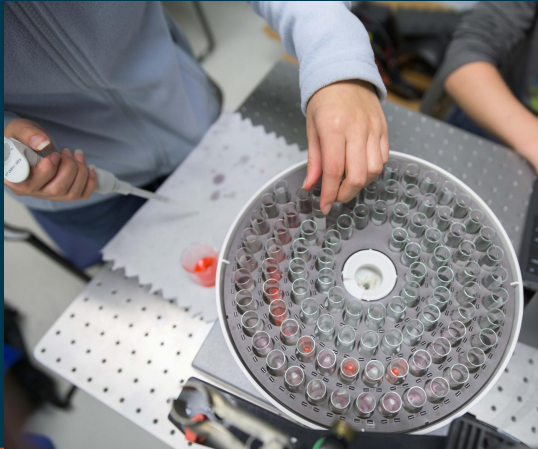


Photo Credit: Willamette University

11/30/2022 Test 1									
Uncertainty of +/- .1 mL			Micro Pipet Pulls of Water			Micro Pipet Pulls of Oil			
Tube #	Water (mL)	Oil (mL)	100 microL pulls	200 microL Pulls	500 microL pulls	100 microL pulls	200 microL Pulls	500 microL pulls	
2	0.1	0		1	0	0	0	0	0
3	1.55	0.05		1.5	2	2	0.5	0	0
4	3.15	0.05		6.5	0	5	0.5	0	0
5	2.95	0		4.5	0	5	0	0	0
6	2.85	0		3.5	0	5	0	0	0
7	0.2	0		2	0	0	0	0	0
8	0	0		0	0	0	0	0	0
9	0	0		0	0	0	0	0	0
10	0	0		0	0	0	0	0	0
11	0	0		0	0	0	0	0	0
12	0	0		0	0	0	0	0	0
13	0	0		0	0	0	0	0	0
14	0	0		0	0	0	0	0	0
15	0	0		0	0	0	0	0	0
16	0	0		0	0	0	0	0	0
17	0	0		0	0	0	0	0	0
18	0	0		0	0	0	0	0	0
19	0	0		0	0	0	0	0	0
20	0	0		0	0	0	0	0	0
21	0	0		0	0	0	0	0	0
22	0	0		0	0	0	0	0	0
23	0	0		0	0	0	0	0	0
Remainder	0.55	1.25		5.5	0	0	0.5	1	2

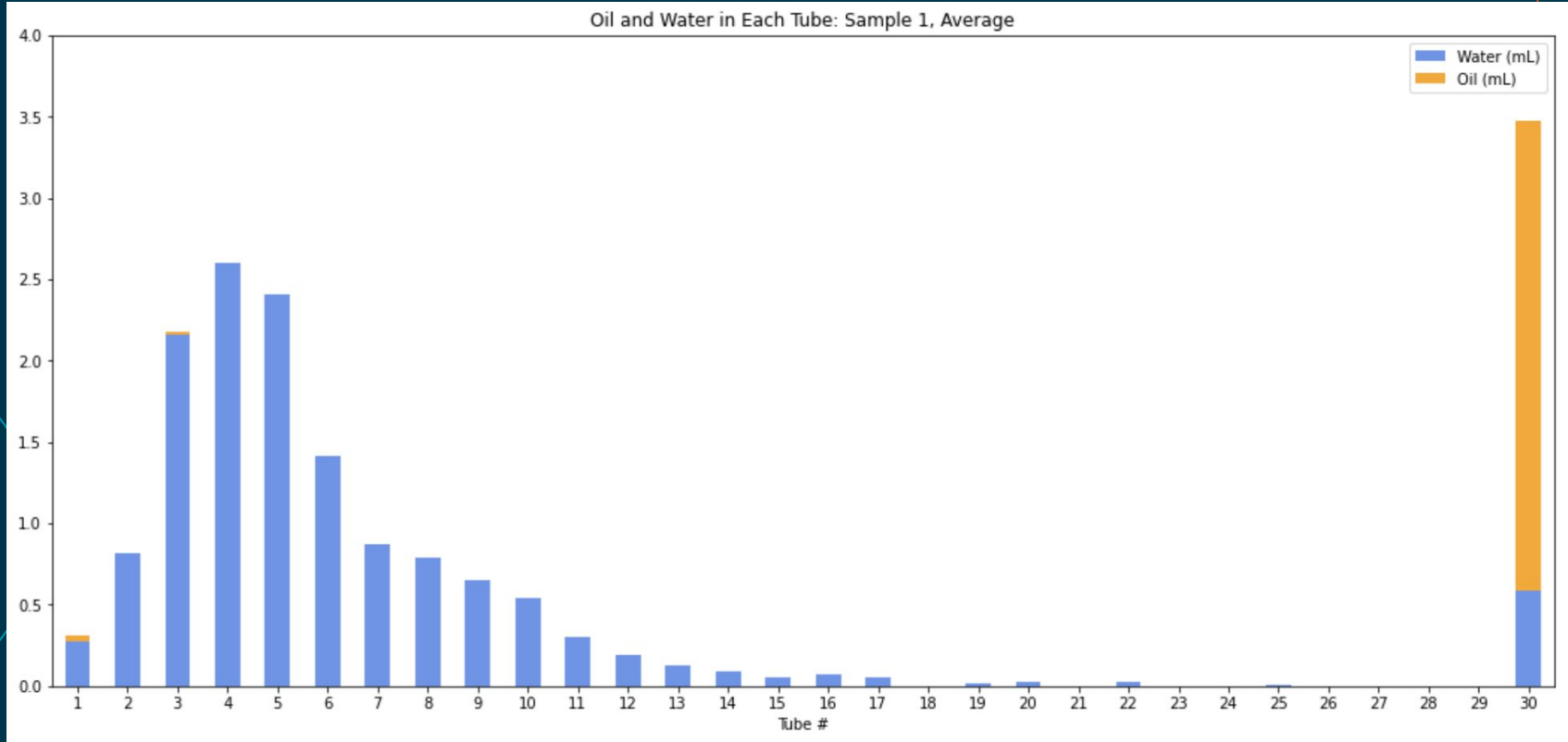




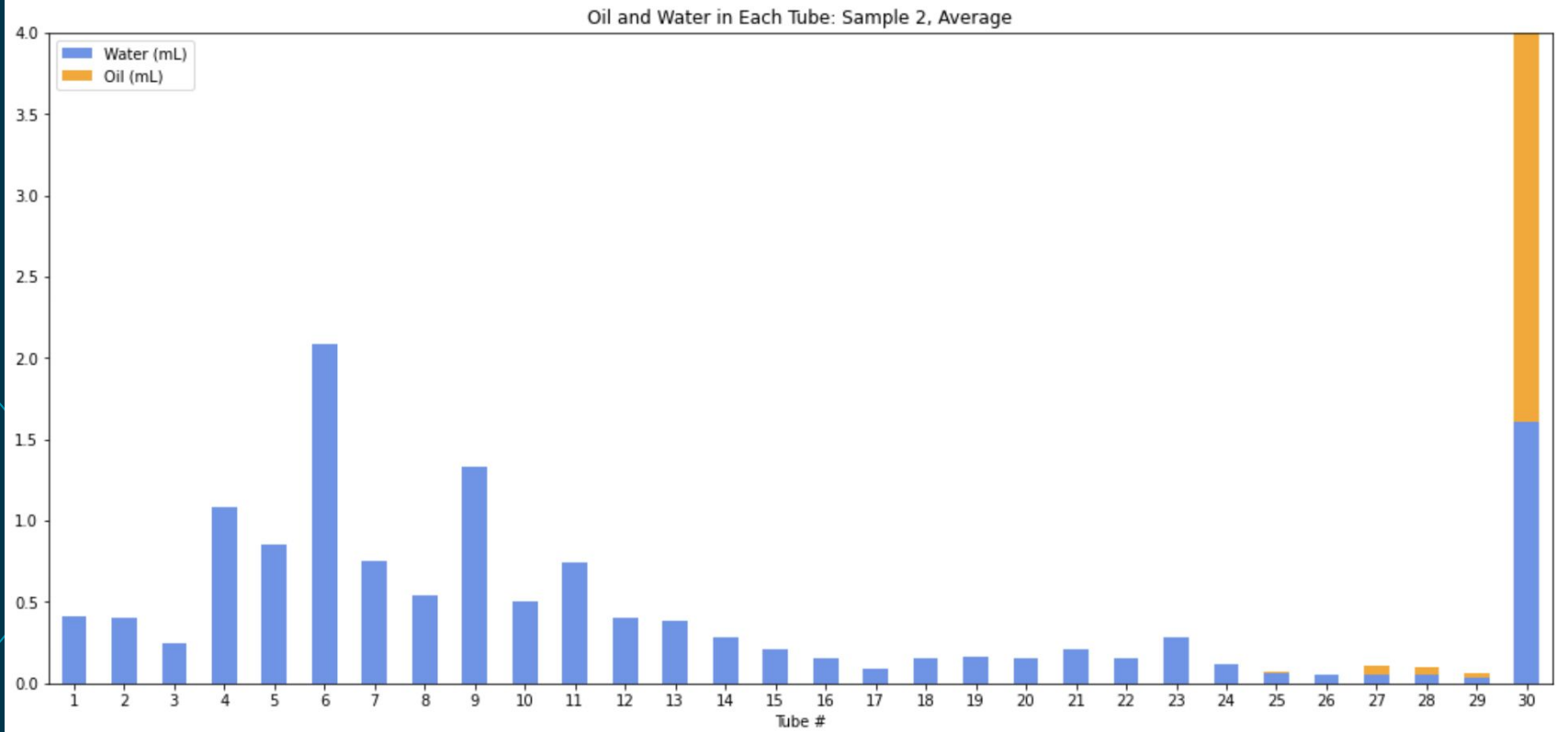
05

Data and Results

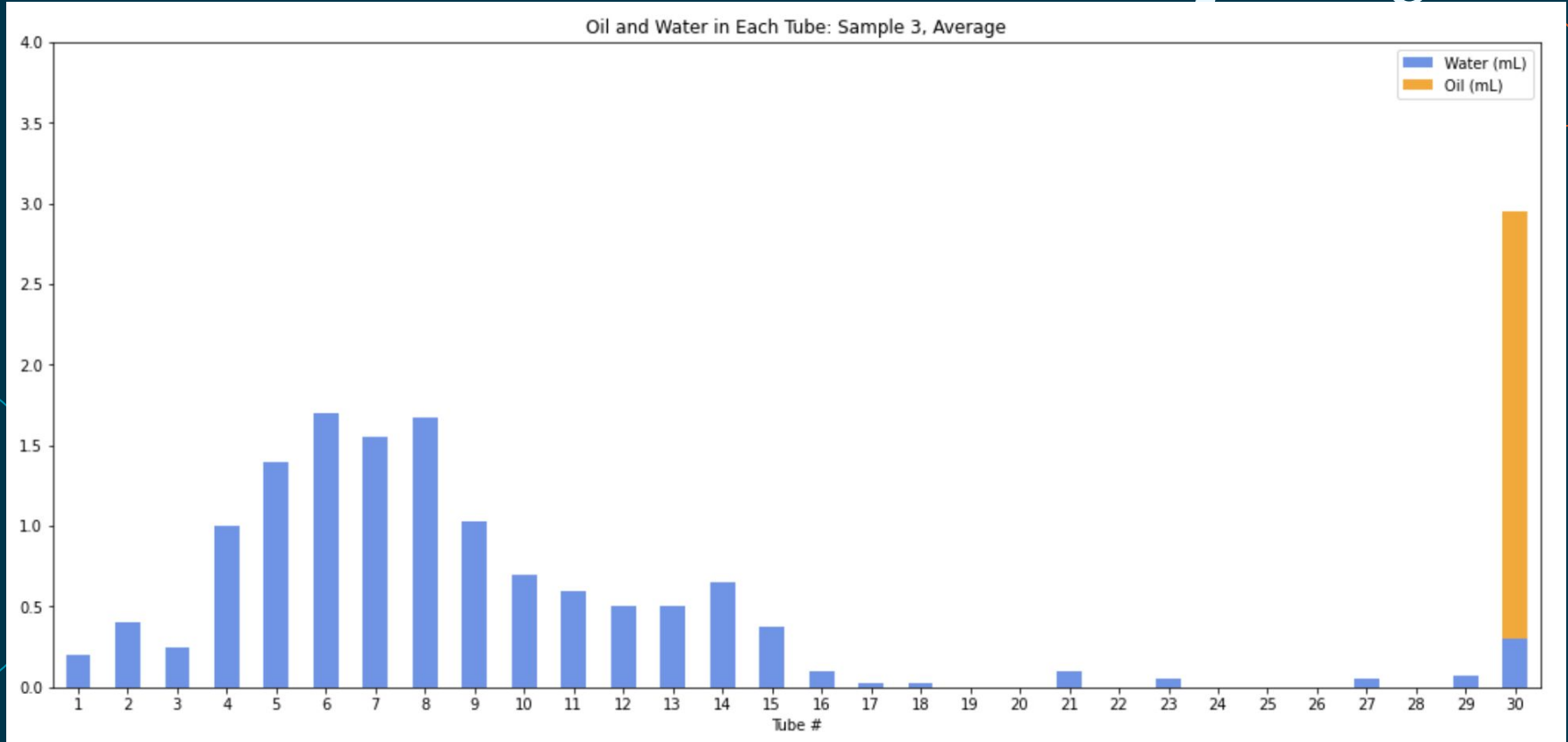
80 micron/ms with 10 micron spacing



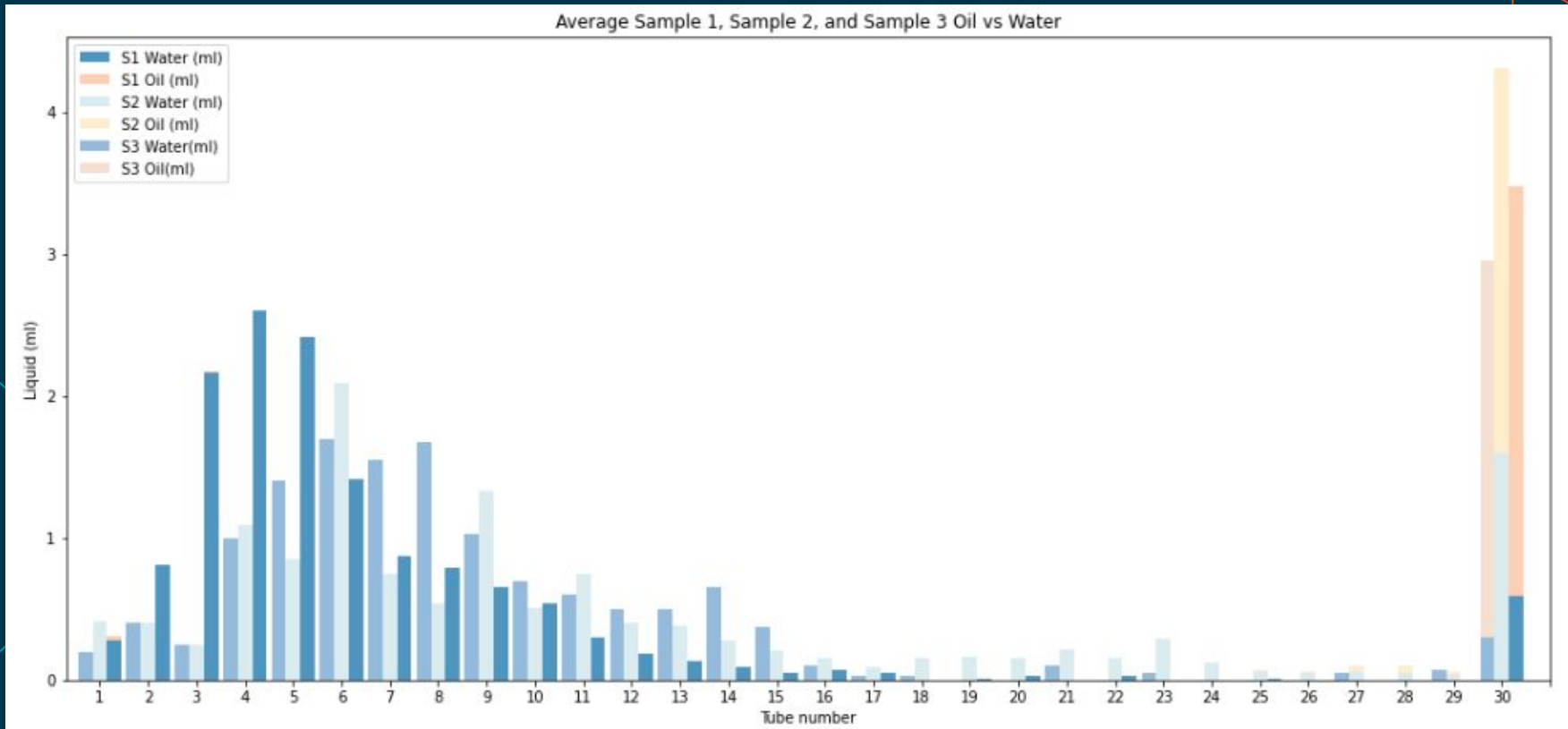
40 micron/ms with 20 micron spacing



80 micron/ms with 20 micron spacing



Analysis





06

Conclusions

Conclusions

- Each Sample proved effective in oil water separation
- 40 micron/ms with 20 micron spacing was the least effective method
- 80 micron/ms with 10 micron spacing looked to be the fastest
- 80 micron/ms with 20 micron spacing looked to have least oil throughout and least water in remainder tube




Future

Short Term:

- Work on last samples (80 micron/ms with 20 micron spacing and 40 micron/ms with 10 micron spacing)

Longer Term

- Different temperatures of water and oil
 - Different types of water (tap vs salt, etc)
 - Different types of oil
 - Different types of mesh
- 

Acknowledgements

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Resources

Fish Scales and Pulsed Lasers to the Rescue: Using Biomimicry of Fish Scales to Design an Environmentally Friendly Mesh to Aid in Oil Spill Clean Up by Madolyn Kelm, 2022

Russo, Richard E., et al. "Laser Ablation." *Elsevier eBooks*, 2007, pp. 41–70.
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