# IPA-Resin Wash System for SLA 3D Printing

**Kyle Abrahm, Claire Barry, Aiden Crowe, and Sam Savitt**
Duke University, Pratt School of Engineering; Blur Product Development

## Design Problem

Our goal is to effectively mitigate the costs, labor, and environmental impacts associated with disposing of mixtures of isopropyl-alcohol (IPA) and resin by purifying the IPA from these mixtures.

## Motivation

- Stereolithography (SLA) 3D printing is the process of using UV-cured resin to create parts in layers. SLA printing is often used in rapid prototyping.
- Excess uncured resin is cleaned from the surface of finished parts using an IPA wash station separate from the printer itself
- The IPA dissolves the resin, so once it becomes saturated, it can no longer clean parts effectively.

- The resulting resin-IPA waste mixture must be disposed of through an expensive and labor intensive hazardous waste management process
- **By creating a solution that can purify and recycle IPA from the waste, we can reduce the costs and environmental consequences of rapid prototyping while increasing its overall effectiveness and efficiency**

A FormLabs SLA 3D Printer

A FormLabs wash station used to clean prints with IPA

## Design Criteria

| Criteria | Target |
|---|---|
| Ease of Use | Singular user input during cleaning (<5 min to set up) |
| Effectiveness | 75% return of IPA |
| Speed | 8 hours/~2 gal cycle |
| Cost | <$200/unit |
| Durability | >1 year |

## Design Solution

IPA resin mixture heated with induction hot plate

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IPA evaporates into condenser

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Cool water pumped through condenser to absorb heat from IPA

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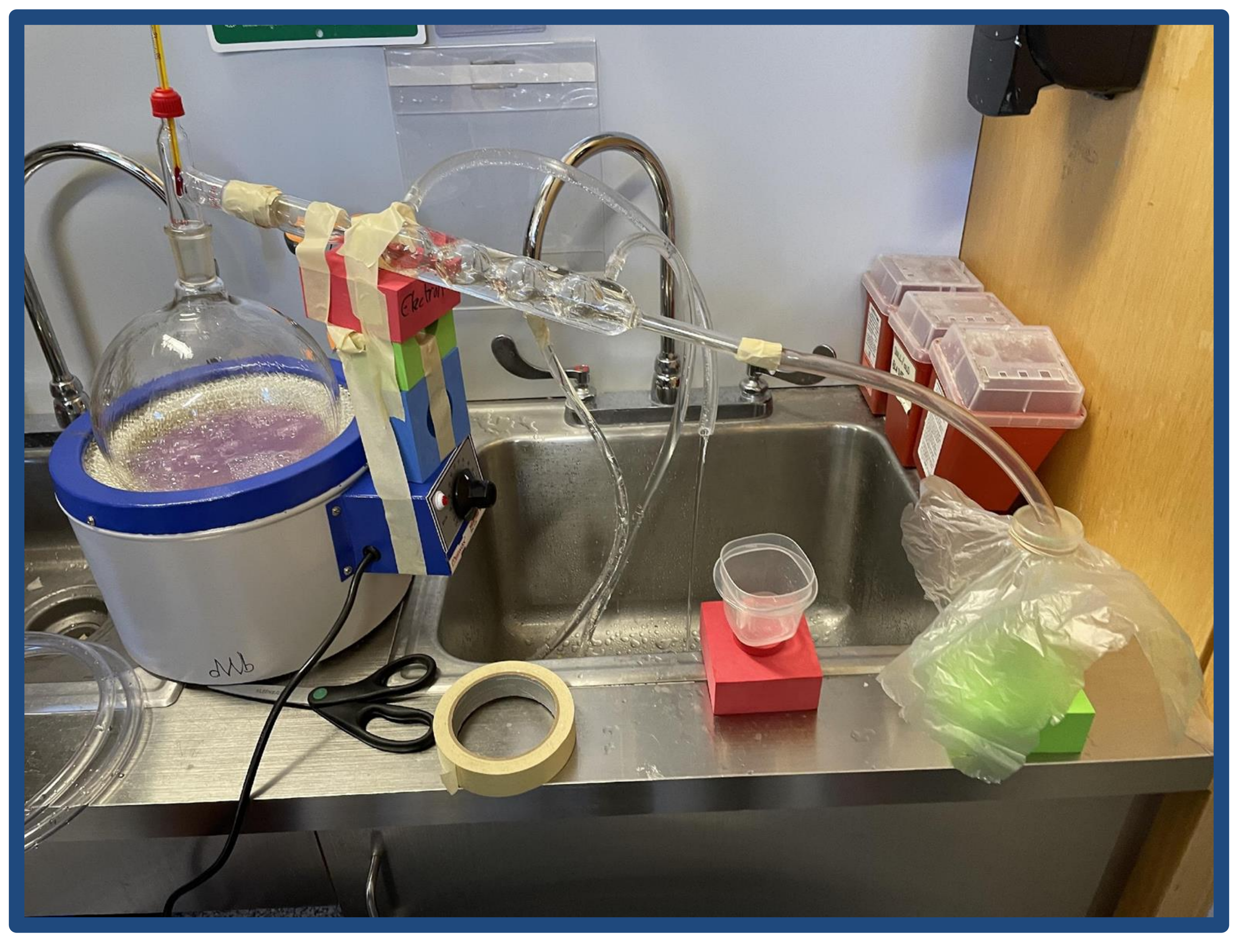
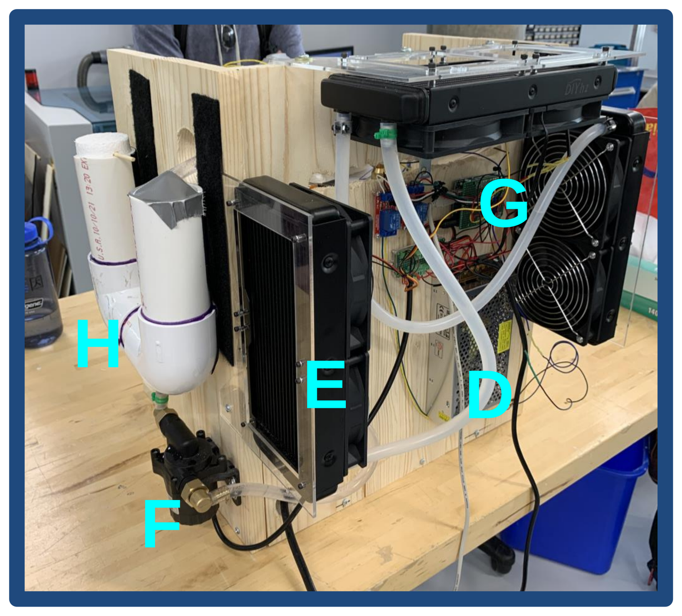
Pure IPA condenses into liquid form and flows into wash basin



Distillation prototype – not automated but proved effectiveness of distillation for purification


Final automated prototype – singular press of the power button initiates distillation cycle

A: Condensing Pot (Cools IPA vapor with water)
B: Main Boiler (Holds IPA/Resin Mixture)
C: Induction Heating Plate
D: 12V Power Supply
E: Radiator (cools water)
F: Pump (pumps water through radiator
G: Arduino
H: Water Tank

## Testing

### Test 1

| | |
|---|---|
| Initial Waste Volume | 2.3 L |
| Volume IPA Distilled | 600 mL |
| Duration of Test | 14:22 |
| Percent Return | 25% |

Device successfully distilled IPA at a fast rate with adequate ease of use, effectiveness, and speed, however the condensing system overheated and the test was cut short.

### Test 2

| | |
|---|---|
| Initial Waste Volume | .9 L |
| Volume IPA Distilled | 550 mL |
| Duration of Test | 12:55 |
| Percent Return | 60% |

**Notes:** These tests were both conducted before the installation of our improved condensing system

## Conclusions

Our device efficiently separates and purifies IPA from an IPA-resin mixture, reducing costs and labor and improving prototyping efficiency

Further testing needs to be done to accurately assess the full capabilities of this device. Running at-scale tests of its distillation would give these data.

## Future Work

- Make device more aesthetically pleasing, efficient, and cost-effective
  - Adjust materials
  - Develop more effective heating/distillation systems specifically for our device
  - Redesign casing for higher fidelity
  - Optimize code for more expedient purification
- Improve safety
  - Include protective box for cables
  - Add strain relief for electrical components

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