

Progress Report 9: March 23 to April 12, 2007

MALDI-MSI Tissue Coating Device

Client: Dr. Amy Harms, Ph.D., Biotechnology Center

Advisor: Professor Brenda Ogle, Biomedical Engineering

Team Members: Laura Piechura (Leader)

Kellen Sheedy (Communicator)

Holly Liske (BWIG)

Jenna Spaeth (BSAC)

Problem Statement

Matrix-assisted laser desorption/ionization mass spectrometric imaging (MALDI-MSI) is an imaging method that allows for label-free spatial analysis of biological tissue samples. This technology can be used to identify and quantify proteins, monitor protein biomarkers, and sequence polypeptide chains, techniques that can be applied to proteomic analysis of disease formation. However, sample preparation methods, especially with regard to the application of the matrix tissue coating, are difficult to control but require accuracy and precision. A device must be developed to apply a fine, uniform coating of light-absorbing compounds in order to simplify the sample preparation process. The goal is to provide a reliable tool to enhance the MALDI-MSI technique in order to speed and simplify potentially life-saving research.

Goals for the week of March 16 to March 22, 2007

- With the input provided by our client at our last meeting (March 16), we have decided to explore the option of incorporating time-delay relays into the circuitry of our conveyor system in order to minimize user-interaction. We will conduct further research into the relays with the hope of finding some less expensive options for the design.
- In addition, we will finalize more of the parts that require ordering through our client and send her another list of components to order. These items will hopefully include the valve to be incorporated into the spray gun.
- Finally, we hope to receive the parts that were ordered last week and begin mocking-up the final prototype. The information we will obtain from this mock-up will help us finalize decisions on some of the parts we have yet to order, including the necessary size of our final design, which will determine the amount of plastic required for assembly.

Summary of Accomplishments

- On March 23, we met with Professor Ogle during class to discuss the midsemester report and our team evaluations. She was pleased with the paper, and confirmed the fact that according to our evaluations, team morale is high and group work thus far has been successful. We also set a meeting with Dr. Ogle on Tuesday, March 27 at 3:00 pm in her office, as we would not be having regular class time on the 30th due to a planned presentation.
- On March 23 we also received notice from our client that the air sprayer, pipe fitting, and matrix reservoir from Paasche© had arrived.
- On March 27th, these parts were picked up from the Biotechnology Center prior to the meeting with Dr. Ogle. The main purpose of the meeting was to ensure that we had begun to order parts prior to the spring recess, which we were able provide proof of, and we examined the sprayer and pipe fitting with Dr. Ogle. The assembled spraying unit was heavier than we had initially thought it to be, but in all, the system looked promising and professional. After the meeting, we attempted to test the spraying capabilities of the air gun, but were unable to find an air tank with a regulator in the BME shared lab. To solve this problem, Dr. Ogle offered to purchase an air tank for testing purposes and said she had an extra regulator we could use as well.

- On Thursday, March 29, we received notice from our client that the motor and power supply from MPJA, Inc. had arrived. Holly picked up these parts.
- Over Spring Break (March 31 to April 8), Laura took home the spraying parts and Holly took home the motor and power supply. Pictures were taken of the air gun, pipe fitting, and matrix reservoir, and sent to the group for reference during the recess. With the aid of the pictures and parts, we used the time over break to brainstorm manners in which we could mount the spraying apparatus atop the box, as the initial method we had imaged with the sprayer held by an o-ring is no longer sufficient given the weight of the air gun. Also, Holly did some additional designing of the conveyor, and she devised a way to achieve the time-delay relay effect of only having to initiate the motion of the belt one time, but without any additional expense. In addition, over Spring Break, Laura discovered an air compressor that could be used to test the spray gun until the air tank that Dr. Ogle had ordered has arrived.
- On April 10, the group reconvened to test the capabilities of the sprayer with the air compressor. We were able to shoot water out of the sprayer in a very fine mist at 50 psi. We were able to use the steel plate that our client mounts her tissue samples on to see how the water would fall on the plate. Also, we did some spraying with the air brush as a standard of comparison, and found that the air gun could spray a mist just as fine, but with fewer abnormalities and at a faster rate.

The Week's Goals

- On Friday, April 13, we will use our class time to make decisions about the quantity of plastic we need to order for our polypropylene encasing, the length and specifications of the belts we'll need for the conveyor, and send this information to our client.
- In addition, we'll conduct additional testing with the air compressor or air tank if it has arrived, create a more detailed timeline as to when we'd like each individual component of our prototype fabricated by, perhaps divide into specialized teams to complete these tasks, and begin construction with the parts that we have and those that arrive throughout the week.
- If enough of the parts arrive within the week for us to create a rough mock-up of the prototype, we may take a trip to the hardware store to begin purchasing the smaller hardware required to assemble the final design.

Project Difficulties

No difficulties related to the project were experienced this week.

Activities

Team Member	Activities	Time for Week	Total Time
Holly	Research of conveyor design and components, mounting alternatives, group meetings	9 hours	54.5 hours
Jenna	Research of mounting alternatives, group meetings	8 hours	53 hours
Kellen	Research of mounting alternatives, group meetings	8 hours	53 hours
Laura	Research of mounting alternatives, group meetings, Progress Report 9	8 hours	55.5 hours

Project Timeline

	2/2	2/9	2/16	2/23	3/2	3/9	3/16	3/23	3/30	4/6	4/13	4/20	4/27	5/4	5/9	5/11	
Client Meeting	Δ																
Research Project	Δ	◆															
Write PDS		Δ															
Brainstorm Design Ideas		Δ		◆													
Choose 3 Designs to Enhance					Δ												
Chose 1 Design to Pursue					Δ												
Work on Midsemester Presentation					Δ												
Work on Midsemester Paper					Δ		◆										
Finalize Design					Δ												
Order Materials					Δ												
Build and Test Prototype					Δ												
Work on Poster Presentation							Δ										
Work on Written Report												Δ					
Final Meeting with Advisor													Δ				
																	Δ

SPRING BREAK