Using Lyophilization To Create Reagent Pellets for Rapid Covid 19 Testing

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Basis Primary School
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NSF RET Award number 1953745
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RET Research and Training

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Hands On Technical Training

- Canvas: Machine learning videos, sensor videos, sample work, training
- Explored: machine learning with cat and dog dataset
- Researched: Reagents, lyophilization, PoCT devices, cryoprotectants

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RET Schedule and Training

Technical Exposition

- Kristen Jaskie - ML algorithms
  - Clustering and K-means
  - Regression and prediction
  - Classification
  - Neural networks
- Mike Stanley - Intro to ML
  - Embedded machine learning
  - Embedded Hardware
  - Software development

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Research Objectives

- Create a rapid PoCT device that test for Covid-19 in saliva to send to developing countries. We plan to lyophilize reagents that are viable and able to withstand uncertain temperatures then place them into a PoCT device that is user friendly.

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Research Background

• In order to create a reagent that is viable after lyophilization, we must research cryoprotectants to ensure that the proteins are not being denatured during the lyophilization process.
• Similar work has been done to determine a PoCT device that adheres to the WHO guidelines. We plan to utilize that information to create a PoCT device.
Research Proposal

Abstract—With the widespread infection of Covid-19, development of rapid Covid-19 tests is essential. Lyophilization is a drying process that allows for long term stability. Many factors come into play when trying to successfully Lyophilized reagents including the ingredients of the reagent. If the proteins of the reagent are broken down in the process, the reagent is no longer effective in detecting Covid-19 in a patient. Once lyophilization is successful you must look at how tests can be distributed. While determining the best distribution method, a Point of care testing device is required.
RET Lab Experience Research Summary

Research Conclusions

No conclusion yet… Continue research on cryoprotectants, lyophilization temperatures, and device structure

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Next STEPS in Research

• Continue with machine learning to bring into the classroom.
• Finalize IEEE report
• Implement the lesson I created with my students and publish it in Teach Engineering
• Finalize my poster project with my classroom implementation.

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Lesson Objectives

• Students explore problem solving techniques by researching, analyzing, and evaluating the pH of water through the manufacturing of pH pellets.

• During the activity, students research the importance of pH in consumable water. After reviewing how to use ImageJ to analyze data, students create their controlled pH pellet.

• Students develop two different formulas along with a controlled formula to create the most sustainable, inexpensive, and accurate pH pellet.

• With the chosen formula, students create different size pellets. Students utilize ImageJ to determine the average size of the pellet with the most cost efficiency, accuracy and sustainability.

• Students present their data in the form of a poster project.
Lesson Description

• This is in inquiry based lab where students are able to explore, draw conclusions, and obtain data.
• NGSS Standards
  • HS-PS1-5.
    • Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
  • HS-LS2-.1
    • Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
  • HS-ESS3-3
    • Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

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Questions & Feedback

• What’s one thing you liked about the lesson and one thing you think I should still be thinking about?
Self Assessment

The best parts...
- Hands-on learning in the laboratory.
- Researching a topic that is relevant at the moment
- Creating a lesson that my students will love and remember

Challenges
- It was hard to join the meetings during the day and a lot of work to catch up on what I missed when doing the laboratory research.
- Writing IEEE report without a deep understanding of the topic

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References


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