



Lesson Plan

Micro Algae

Created: 02/2019 by the National FFA Organization

SAE Video Summary: *Algae is commonly found on top of ponds and bodies of water and not thought about beyond that point. However, Abbigail Lozon has found a supervised agricultural experience (SAE) program that involves producing algae to feed to various species being produced in her school. Through her SAE, she has acquired many skills that will better prepare her for her future career.*

STUDENT LEARNING OBJECTIVES:

After completing these activities, students will ...

1. Describe an SAE.
2. Describe algal biofuel.
3. Describe and illustrate algal biofuel production.

TIME REQUIRED: 60 minutes

RESOURCES:

1. "Abbigail Lozon – SAE – Micro Algae," <https://vimeo.com/300298469>
2. Algae as Biofuel, <http://large.stanford.edu/courses/2014/ph240/anderson-m1/>

EQUIPMENT AND SUPPLIES NEEDED:

1. A copy of the "Green Energy" worksheet for each student
2. Internet access to play the video in real time or embed it in a PowerPoint ahead of time

THIS QUICK LESSON PLAN WOULD WORK WELL AS:

1. An SAE lesson.
2. A plant science lesson.
3. A biofuel lesson.

STUDENT ACTIVITY SHEETS:

Direct access to student activity sheets without lesson plan or answer key for easy upload to learning management systems or printing for classwork.

<https://ffa.box.com/s/dhon31qzq21ptz2jcxslw2z1jpjbjiyb> (Word)

<https://ffa.box.com/s/np7np9rj0avvy63ou8d3w4r4lv1c1iw> (PDF)

THESE ACTIVITIES ARE ALIGNED TO THE FOLLOWING STANDARDS:

FFA Precept

- FFA.PL-A.Action: Assume responsibility and take the necessary steps to achieve the desired results, no matter what the goal or task at hand.
- FFA.PL-F.Continuous Improvement: Accept responsibility for learning and personal growth.
- FFA.PG-J.Mental Growth: Embrace cognitive and intellectual development relative to reasoning, thinking and coping.
- FFA.CS-N.Decision Making: Analyze a situation and execute an appropriate course of action.

Common Core – Reading: Informational Text

- CCSS.ELA-Literacy.RI.9-10.2: Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.
- CCSS.ELA-Literacy.RI.9-10.4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).

Common Core – Speaking and Listening

- CCSS.ELA-Literacy.SL.9-10.2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

Common Core – Science & Technical Subjects

- CCSS.ELA-Literacy.RST.9.10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CCSS.ELA-Literacy.RST.9.10.9: By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

Common Core – Math Practices

- CCSS.MP1: Make sense of problems and persevere in solving them.
- CCSS.MP5: Use appropriate tools strategically.
- CCSS.MP6: Attend to precision.

AFNR Career Ready Practices

- CRP.02: Apply appropriate academic and technical skills. Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive.
- CRP.04: Communicate clearly, effectively, and with reason. Career-ready individuals communicate thoughts, ideas and action plans with clarity, whether using written, verbal and/or visual methods.
- CRP.05: Consider the environmental, social and economic impact of decisions. Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organizations and the environment.
- CRP.06: Demonstrate creativity and innovation. Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization.
- CRP.07: Employ valid and reliable research strategies. Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies.
- CRP.08: Utilize critical thinking to make sense of problems and persevere in solving them. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem.

Partnership for 21st Century Skills

- Critical Thinking and Problem Solving
- Environmental Literacy
- Flexibility and Adaptability
- Initiative and Self-Direction
- Leadership and Responsibility
- Think Creatively

LESSON PLAN:

1. *Bell Ringer:* What is algae?
2. *Introduction:* Algae is the green plant-like material that grows on the top of water sources. This green material is often seen as a nuisance by many but can be used for many purposes. Have students brainstorm with a partner why algae could be beneficial. Have pairs share with the class.
3. *Activity:* Each student needs a copy of the worksheet "Green Energy."
 - a. *Part 1:* Students will begin by watching the video "Abbigail Lozon – SAE – Micro Algae" to discover how this FFA member is learning first-hand about small photosynthetic organisms. The video is available at <https://vimeo.com/300298469>. The students will answer the questions as they follow along with the video.
 - b. *Part 2:* Next, students will learn about algal biofuel. Students will read through this resource, <http://large.stanford.edu/courses/2014/ph240/anderson-m1/>, and answer the questions.
 - c. *Part 3:* Now that students have an understanding of algal biofuel and the production process, they will utilize the word bank to create a timeline, with pictures and color, of the algal biofuel process.
 - d. *Part 4:* After students have studied the algal biofuel process, they will have the opportunity to get creative and brainstorm a new potential biofuel (not corn or soybean based). Students will have to use what they have learned and complete some research to develop their new fuel source. Once all of the students have finished, have them think-pair-share with other students.
4. *Follow-up:* Have student compare and contrast different fuel sources to understand a holistic view of the potential energy sources of the future.
5. *Leveling Up:* Have students make a biofuel in class, such as soy biodiesel.

6. *Exit Ticket:* What is algae? How can algae help us with our changing energy requirements?

NAME: _____

Aligned to the following standards:

FFA.PL-A; FFA.PL-F; FFA.PG-J; FFA.CS-N; CCSS.ELA.RI.9-10.2; CCSS.ELA.RI.9-10.4; CCSS.ELA.SL.9-10.2; CCSS.ELA.RST.9.10.9; CCSS.ELA.RST.9.10.4; MP1; MP5; MP6; CRP.02; CRP.04; CRP.05; CRP.06; CRP.07; CRP.08

Green Energy

Part 1

DIRECTIONS:

Watch the video "Abbigail Lozon – SAE – Micro Algae" to discover how this FFA member is learning firsthand about small photosynthetic organisms. The video is available at <https://vimeo.com/300298469>. As you watch, complete the activity below.

How many different types of algae does Abbigail grow?

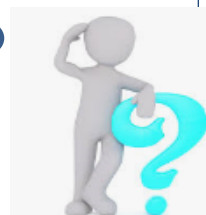
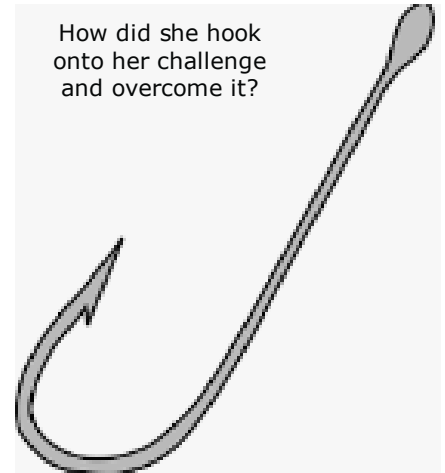
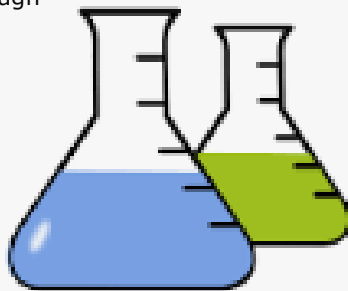
What is the algae used for?

How did she hook onto her challenge and overcome it?

What was her biggest challenge?

What skills did she gain through her SAE?

Aquaculture is a rapidly growing industry. What types of aquaculture are going on in your state?



Part 2

DIRECTIONS:

Algae and micro algae are great feed sources for some aquatic species. However, did you know this green plant can become an energy source as well? Using this website, <http://large.stanford.edu/courses/2014/ph240/anderson-m1/>, answer the following questions and complete the activities.

What is algal biofuel?

What role could micro algae play with regards to CO₂?

What are three benefits of using algae as a biofuel?

1. _____

2. _____

3. _____

Identify two challenges that impact the idea of algal biofuel as a viable source.

1. _____

2. _____

Cultivation Open Pond vs. Photobioreactor



Part 3

DIRECTIONS:

Now that you have some background knowledge of algal biofuels, use the word bank below to create a flow chart of the process of algal biofuel production. Be sure to include pictures, with color, at each step. Remember that flow charts do not have to go in a straight line if there are multiple products, by-products, processing options or processes happening.

Word Bank:

CO ₂	Algae ponds	Carbs
Nutrients	Processing	Proteins
Sunlight	Biodiesel/Jet Fuel	Ethanol
Photobioreactor	Animal Feed	Bioplastics
Water	Algae Oil	Sequestration

What impact do you think algal biofuel could have on your future?

Part 4

DIRECTIONS:

Now that you have an understanding of one new kind of biofuel, develop your own biofuel. Select a commodity that readily exists that have qualities favorable to producing another fuel source (corn and soybeans cannot be used). Identify the raw product, the growing procedures for processing, the steps for processing, the impact the fuel will have and any drawbacks to this specific type of fuel (ex. cannot be grown in certain regions).



Raw product: _____



Growing Procedures:



Steps in Processing:

Impact:



Drawbacks:

KEY: Green Energy

Part 1

DIRECTIONS:

Watch the video "Abbigail Lozon – SAE – Micro Algae" to discover how this FFA member is learning firsthand about small photosynthetic organisms. The video is available at <https://vimeo.com/300298469>. As you watch, complete the activity below.

How many different types of algae does Abbigail grow?

4

What is the algae used for?

It is fed to different species in the lab.

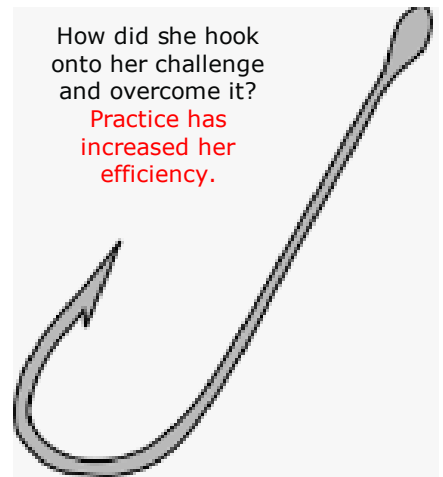


What was her biggest challenge?

Time management

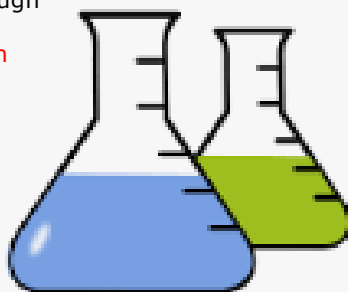
How did she hook onto her challenge and overcome it?

Practice has increased her efficiency.



What skills did she gain through her SAE?

Precision and organization



Aquaculture is a rapidly growing industry. What types of aquaculture are going on in your state?

Answers will vary.



Part 2

DIRECTIONS:

Algae and micro algae are great feed sources for some aquatic species. However, did you know this green plant can become an energy source as well? Using this website, <http://large.stanford.edu/courses/2014/ph240/anderson-m1/>, answer the following questions and complete the activities.

What is algal biofuel? A fuel source made from algae or micro algae that could be an alternative source of energy to fossil fuels.

What role could micro algae play with regards to CO₂? Algae and micro algae are plants, so they utilize CO₂ as a source for food production. Carbon sequestration.

What are three benefits of using algae as a biofuel?

1. Can be grown on land area where other commercial agricultural practices may not be feasible.
2. The process can use a saline solution, which means there would not be a pull on the fresh water supply.
3. If this fuel source was spilled it would not be as environmentally harmful because it is more biodegradable.

Identify two challenges that impact the idea of algal biofuel as a viable source.

Examples: High levels of high polyunsaturated fatty acid chains, still very expensive, still working on an optimal strain for mass production, etc.

Cultivation Open Pond vs. Photobioreactor

Less costly
Must compete with other species
Must have a very hearty algae strain
Must be able to withstand greater pH and temperature changes

More expensive
Uses glass or plastic tubes
Easier to manage
More productive



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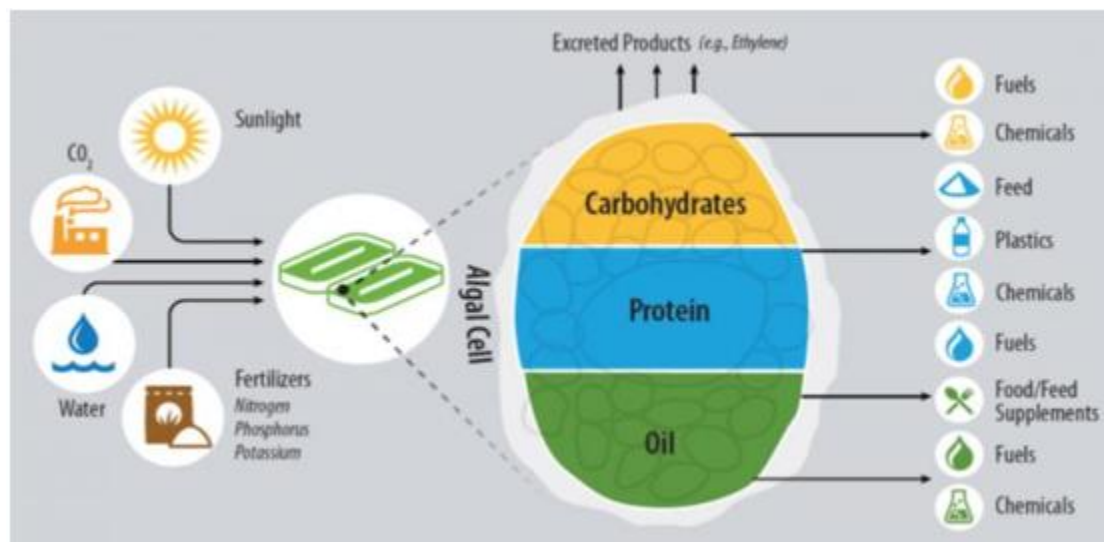
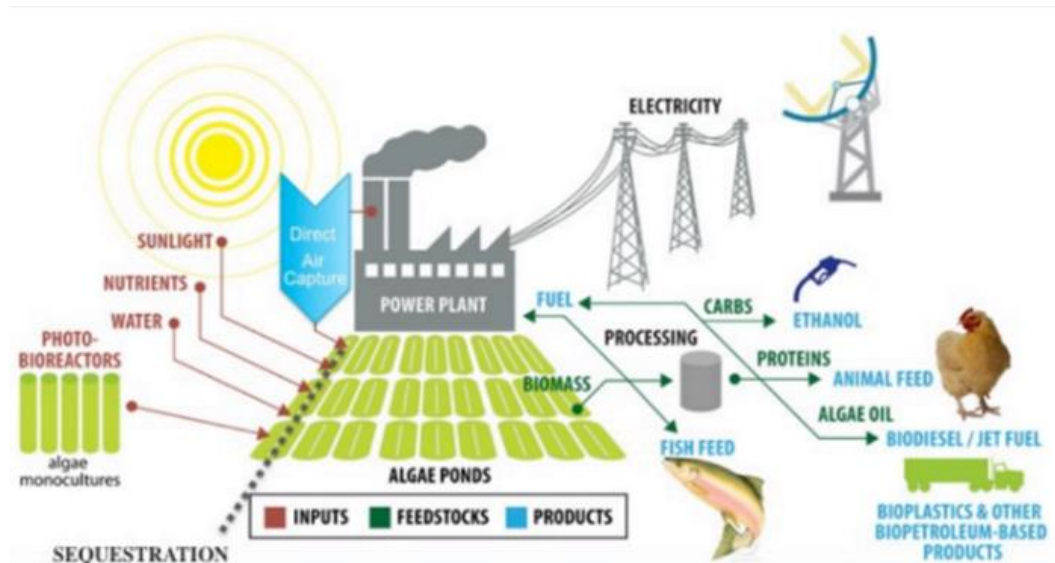
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What impact do you think algal biofuel could have on your future?
Answers will vary.