# Chemical Oxygen Demand Reduction Using the algae *Dunaliella primolecta* and *Chlorella vulgaris*

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## Introduction

Freshwater in California is becoming more and more scarce due to the lack of rain in the past years. Without freshwater in California, the agriculture industry faces high environmental and industrial costs. Because farm industry water is characterized by high organic content and high chemical oxygen demand (COD), farms with large livestock and poultry operations are paying a lot more for water cleaning equipment, therefor it is questioned if a biological treatment system that uses algal growth to create renewable energy in the form of biodiesel is able to remove polluting nutrients and greenhouse gases from dairy wastewater.

We partnered with Biofiltro USA Inc., developers of a filtering method called Biofilter Dynamic Aerobic (BIDA) System, which uses a filtration system of red worms and its castings , gravel and wood shavings to organically clean out waste and contaminant organic nutrients from water. This study compares the reduction of COD in 100% and 50% dairy industry generated wastewater before and after the treatment with the BIDA system. We compared if the algae *Dunaliella primolecta* and *Chlorella vulgaris* would confirm that algae would have the possibility of cleaning out waste content from wastewater and possibly reduce COD.

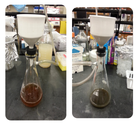
## Objectives

1. To measure the efficacy of a specific method of biological filtrations
2. To observe the changes in COD levels in the presence of different algae species
3.To measure the reduction of chemical oxygen demand by organics in 50% and 100% BEFORE and AFTER wastewater

## Methods

Previous research indicated that the algal species, *Dunaliella primolecta and Chlorella vulgaris* had higher growth rates than *Scenedesmus dimorphus.* Making them the ideal focus of the study.

## Procedure

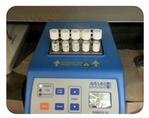


**Prepare Media:**

-Media preparation included BEFORE and AFTER wastewater samples that went through the BIDA system. Both samples went through an extensive filtration process using Whatman filters and 22 µM filters that remove contaminants from the wastewater.

**Algae Inoculation**

-Algae inoculation included adding 160µL of *Dunaliella primolecta* and 211µL of *Chlorella vulgaris*, or 200,000 cells/mL, with 5mL of each 50% and 100% before and after BIDA wastewater.



**Initial COD Measurements**

-Initial COD readings were made for both BEFORE and AFTER 50% diluted wastewater and 100% wastewater.

**Growth Process**

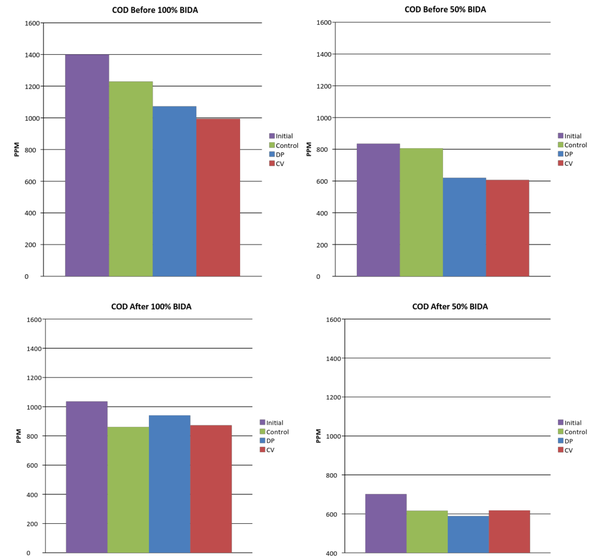
-Algae are kept in the shaker for ten days to optimize growth. The shaker provides light and continuous rotation for the microalgae. On 2nd, 4th, 6th, 8th and 10th day cell counts were completed under the microscope to make sure algae cells were growing in wastewater.

**Final COD Measurements**

-Tubes of algae were vortexed to mix the contents. Final COD measurements were completed on the 10th day. 1mL of each sample were collected and dried for NMR analysis.

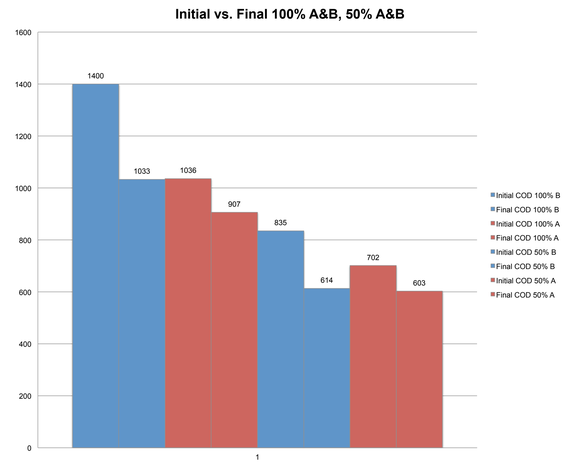
## Results and Discussion

Our research indicates that both algal species reduced the presence of waste content in BEFORE and AFTER BIDA wastewater. In addition, both algal species showed a common trend in how much COD was reduced.




## Results and Discussion

When comparing COD from the initial and final culture time of Before BIDA filtration and After BIDA filtration, we concluded that both algal species removed more waste content in 'Before BIDA' filtration than in 'After BIDA.'




## Conclusions and Future Work

Results from the experiment indicate that both *Dunaliella primolecta* and *Chlorella vulgaris* were able to reduce the amount of organic content in dairy wastewater. In order to confirm our results, more experiments are needed to test if the amount of algae combinations affect how effective algae reduced COD. In addition, further experiments are also needed to test if additional algal inoculation in the 'Before BIDA' filtration will further reduce the amount of organic content and COD in wastewater.

### References

Woertz, I., Feffer, A., Lundquist, T., & Nelson, Y. *Algae grown on dairy and municipal wastewater simultaneous nutrient removal and lipid production for biofuel feedstock.* Civil and Environmental Engineering Department, California Polytechnic State University San Luis Obispo.

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