



# Wastewater Filtration Using *Dunaliella primolecta*, *Scenedesmus dimorphus* and *Chlorella vulgaris*

Tamar Melkonian, Angeles Mora, and Alejandro Calderón- Urrea  
Department of Biology, California State University, Fresno



## Introduction

California is facing a water crisis due to the lack of rain in the recent years. If the state continues without rain, it will eventually run out of fresh water. Because of the high demand for water, agricultural businesses in the central valley are looking for ways to recycle water. In this context, it is questioned if algae can be used as a supplement in wastewater clean-up processes.

A novel wastewater clean-up process uses a filtering method called BioFiltro, patented as Biofilter Dynamic Aerobic (BIDA) System. This system uses layers of red worms in addition with its castings, wood shavings and gravel to clean out the organic material in wastewater. Although this method uses 80% less energy than other conventional methods it still is not able to completely remove all the organic material. In this experiment, we are focusing on growing algae in wastewater before and after it is treated with the BioFiltro system to see if we can further reduce the Chemical Oxygen Demand (COD) of the wastewater.

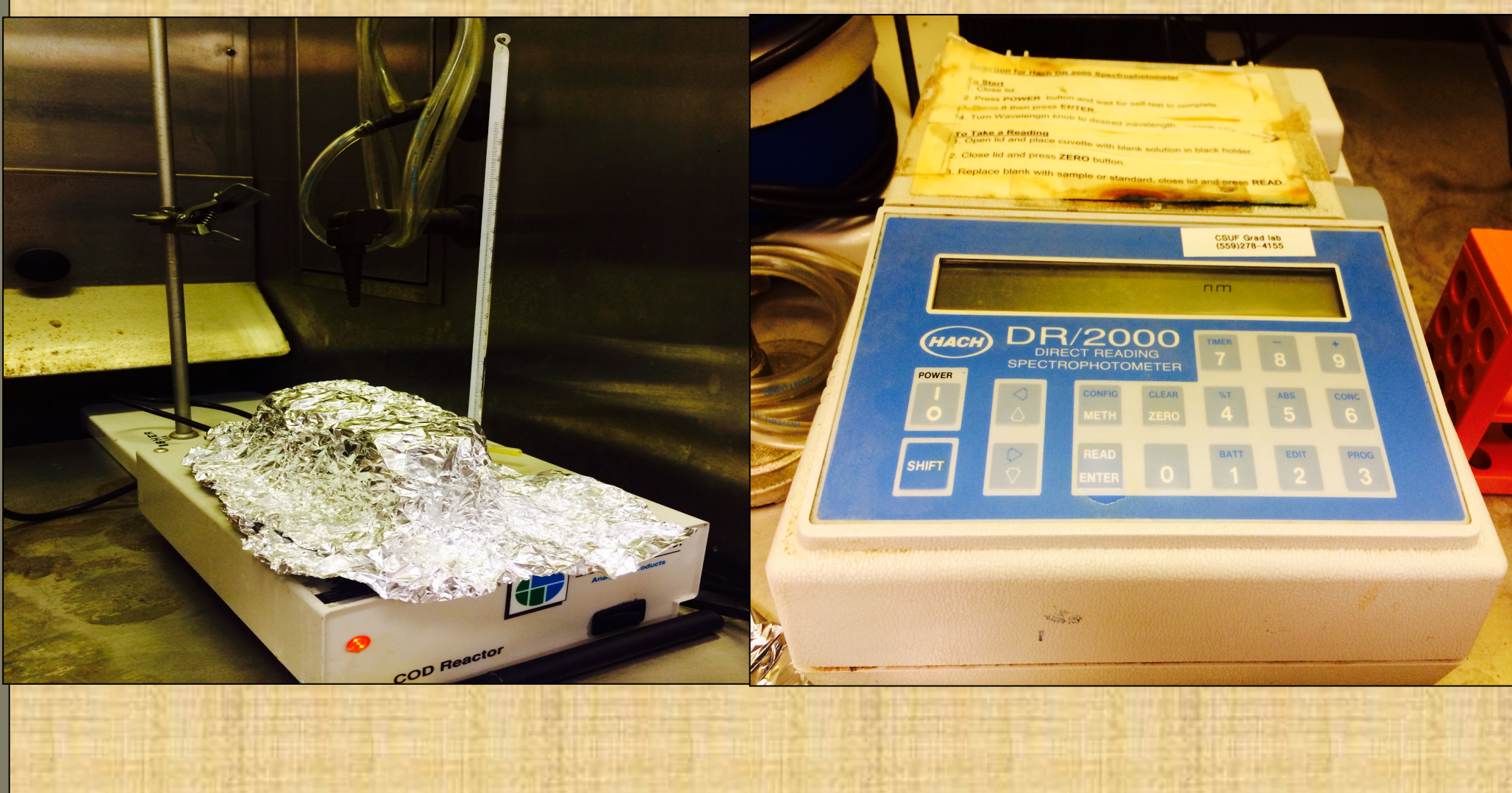
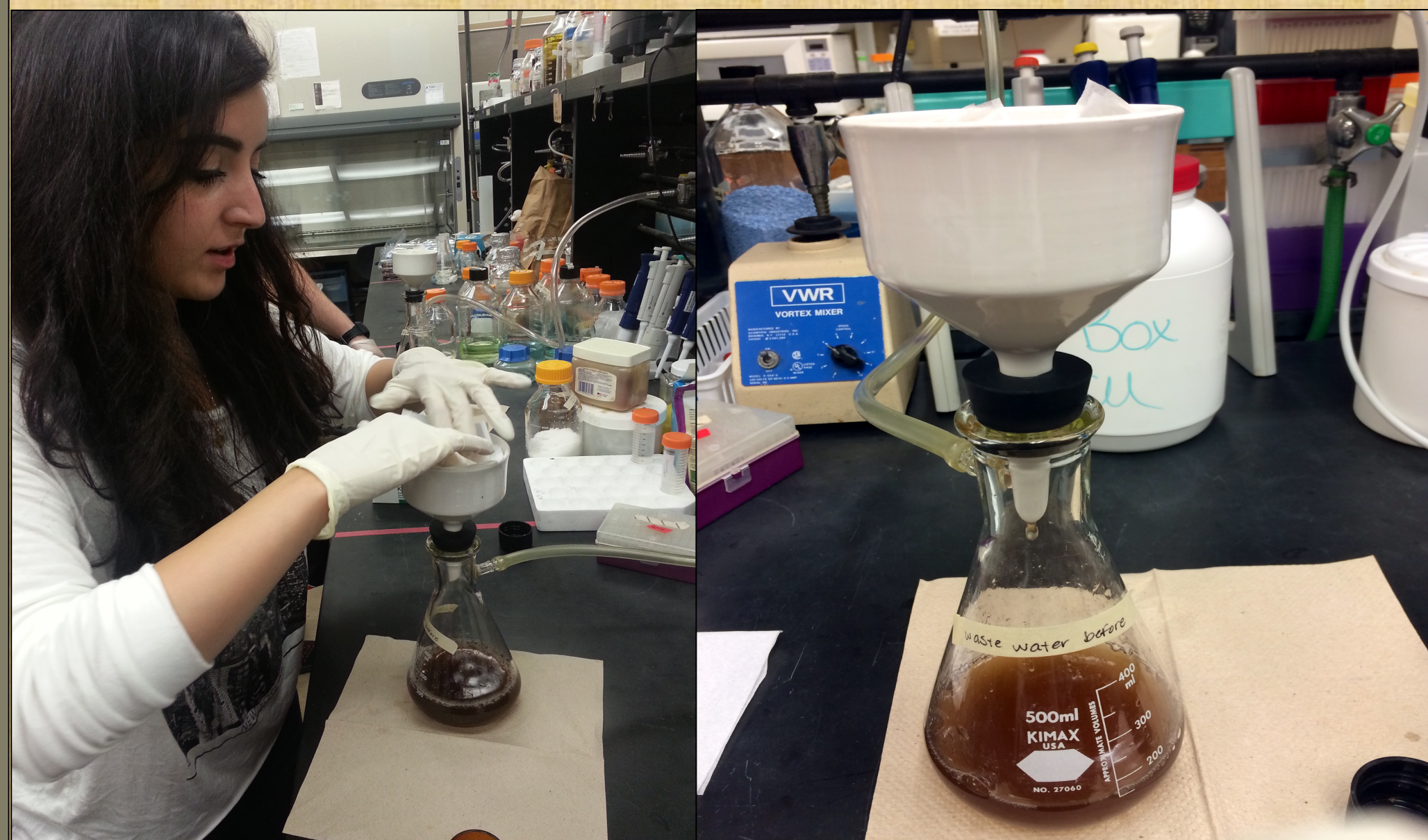
In previous experiments, we determined that Orchid Grow More (OGM) was the common best media for growing the algae. This was used for the diluted wastewater samples.

## Objectives

- 1) To determine if algae can further reduce the COD level of the wastewater samples.
- 2) To observe the fluctuations of COD before and after algae inoculation.
- 3) To compare 100% wastewater media with 50% waste water media and OGM.

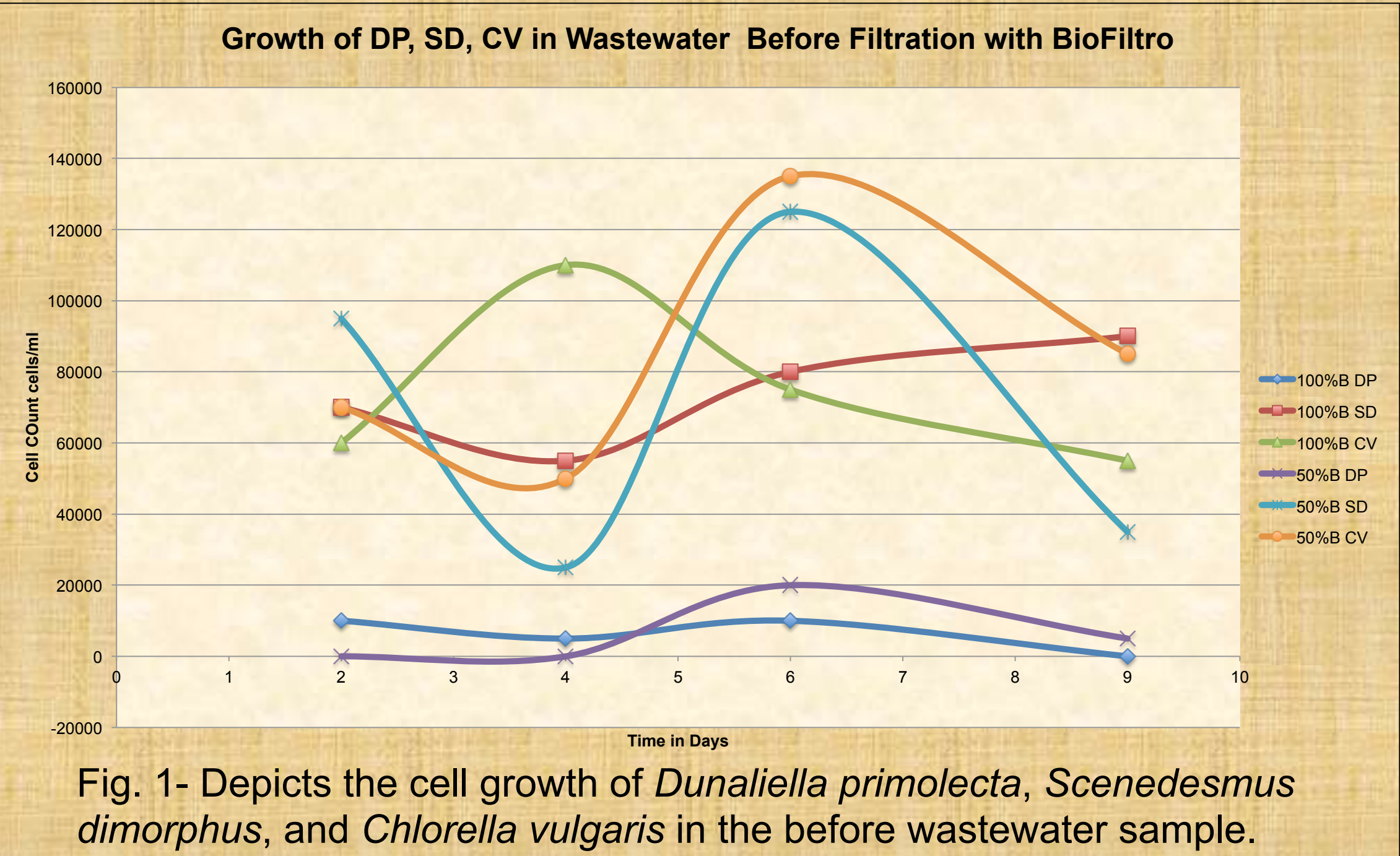
## Methods

Dairy industry generated wastewater samples BEFORE and AFTER going into the BioFiltro system and were collected. Initial readings of COD were made on these samples, as well as in 50% diluted wastewater (the wastewater was diluted with Orchid Grow More medium). These solutions were then filter sterilized to remove undissolved materials and any contaminant microorganisms. The solutions were used as the growing media for the algae *Dunaliella primolecta*, *Chlorella vulgaris*, and *Scenedesmus dimorphus*. After monitoring cell densities for 12 days, observations were made on their growth. The final COD readings were then made. COD measurements were performed with the Chemetrics test.



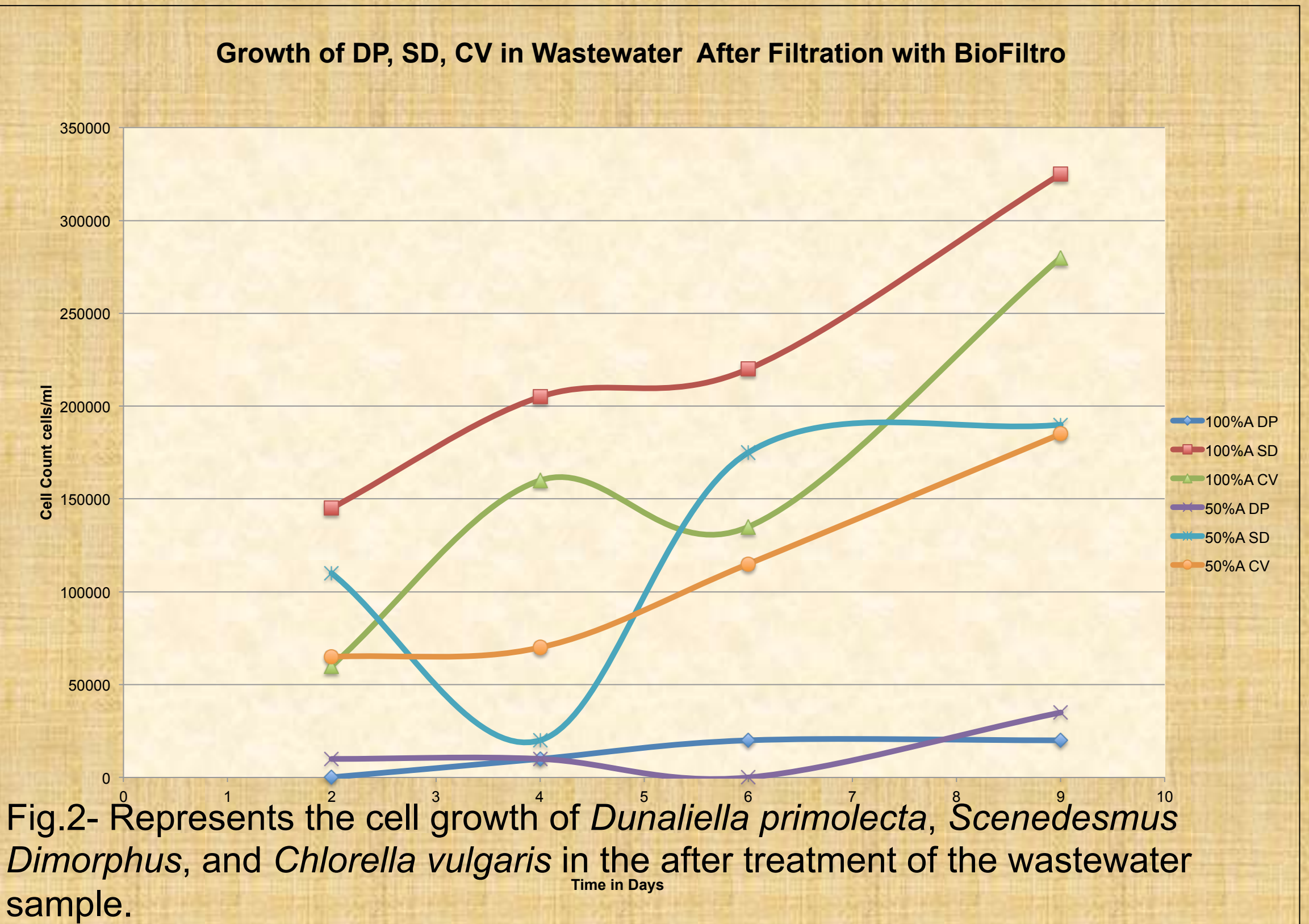
## Results and Discussion

The results from the experiment proved that the algae used were not able to grow in wastewater before filtration with the BioFiltro system; neither 100% or 50% diluted. The reason for this could be because of the abundant amount of organic material present before filtration.



100% concentrated wastewater			
	<i>Dunaliella primolecta</i>	<i>Chlorella vulgaris</i>	<i>Scenedesmus dimorphus</i>
COD <sub>initial</sub>	4668mg/L	4668mg/L	4668mg/L
COD <sub>final</sub>	6026mg/L	6210mg/L	5266mg/L

50% concentrated wastewater			
	<i>Dunaliella primolecta</i>	<i>Chlorella vulgaris</i>	<i>Scenedesmus dimorphus</i>
COD <sub>initial</sub>	2137mg/L	2137mg/L	2137mg/L
COD <sub>final</sub>	6026mg/L	2712mg/L	2804mg/L



100% concentrated wastewater			
	<i>Dunaliella primolecta</i>	<i>Chlorella vulgaris</i>	<i>Scenedesmus dimorphus</i>
COD <sub>initial</sub>	4645mg/L	4645mg/L	4645mg/L
COD <sub>final</sub>	3909mg/L	4714mg/L	4622mg/L

50% concentrated wastewater			
	<i>Dunaliella primolecta</i>	<i>Chlorella vulgaris</i>	<i>Scenedesmus dimorphus</i>
COD <sub>initial</sub>	1700mg/L	1700mg/L	1700mg/L
COD <sub>final</sub>	4277mg/L	181mg/L	2436mg/L

However, when the wastewater was filtered with BioFiltro and diluted 50% with the Orchid Grow More media, the algae were able to grow well. Furthermore, *Chlorella vulgaris* was able to reduce the COD by approximately ten-fold when grown in the 50% wastewater.

## Conclusions and Future Work

Our results suggest that algae can be used to reduce the amount of organic material in dairy wastewater. More experiments are needed to confirm our results and to test if combinations of algae are also effective at reducing COD.

## References

- <http://biofiltro.com/>
- Andersen, R. (2005). *Algal culturing techniques*. Burlington, Mass.: Elsevier/Academic Press.

## Acknowledgments

This work was supported by the Chevron Corporation, Howard Hughes Medical Institute, the National Marine Sanctuary Foundation, National Science Foundation, and S.D. Bechtel, Jr. Foundation. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the funders. The STAR program is administered by the Cal Poly Center for Excellence in STEM Education (CESAME) on behalf of the California State University. The authors acknowledge the technical support of Alejandro Hernandez, undergraduate student at Fresno State. The authors also thank BioFiltro for providing the wastewater samples.

