Title Page

NATIONAL ENERGY TECHNOLOGY LABORATORY

Developing Cost Effective Biological Removal Technology for Selenium and Nitrate from Flue Gas Desulfurization (FGD) Wastewater from an Existing Power Generating Facility

Dr. Sanju A. Sanjaya
Energy and Environmental Science Institute
West Virginia State University (WVSU)
sanjaya@wvstateu.edu

Project Description and Objectives

The overall goal of our project is to investigate and determine a technically feasible and cost-effective process for designing photosynthetic organisms capable of sequestering Se and nitrates from FGD wastewater. To realize this goal, we have chosen to focus on the following 2 objectives:

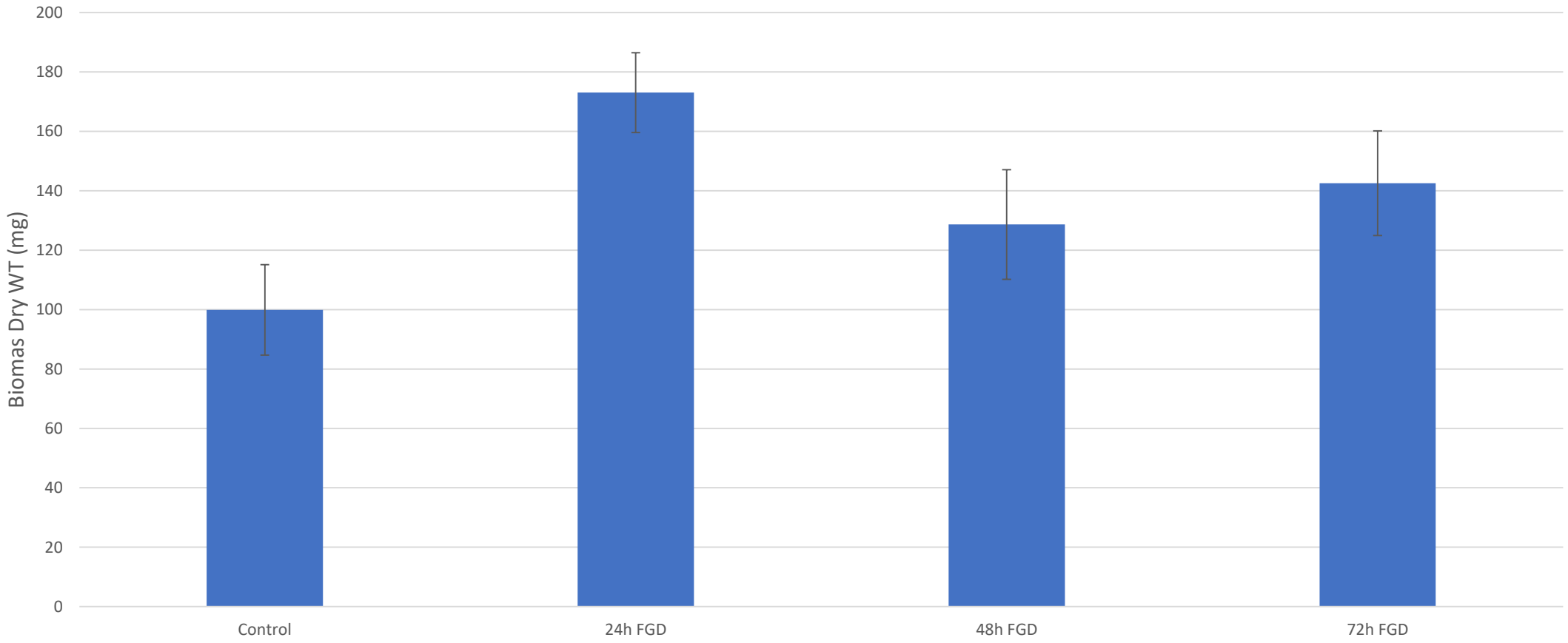
(1) Investigate changes in transcripts and metabolism in algae and plants in response to FGD wastewater.

(2) Explore biotechnological strategies to increase sequestration of Se and nitrates in biomass to improve agricultural productivity.

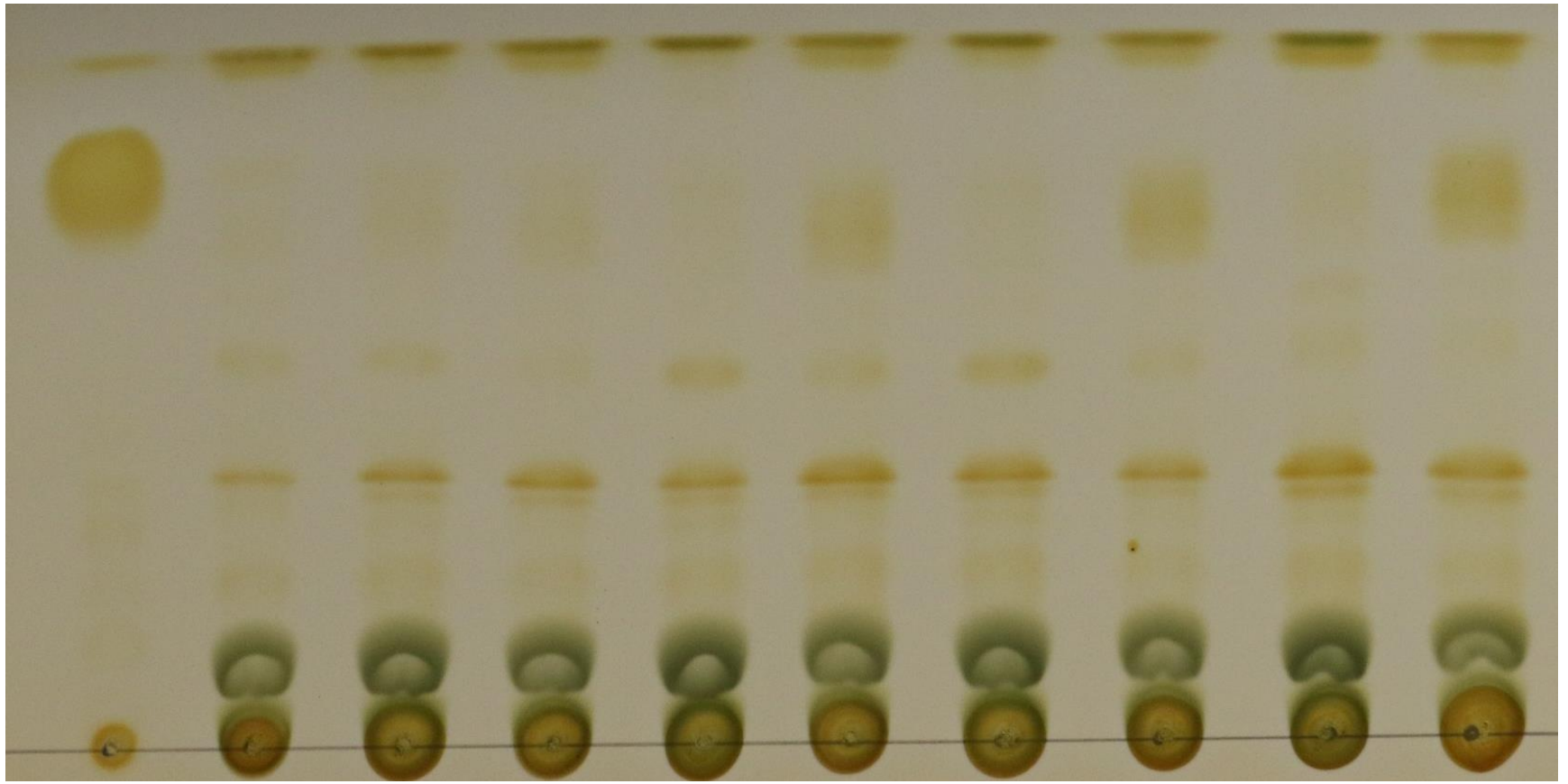
Academic objective: to enhance student hands-on experience and participation in STEM research and education

Project Update

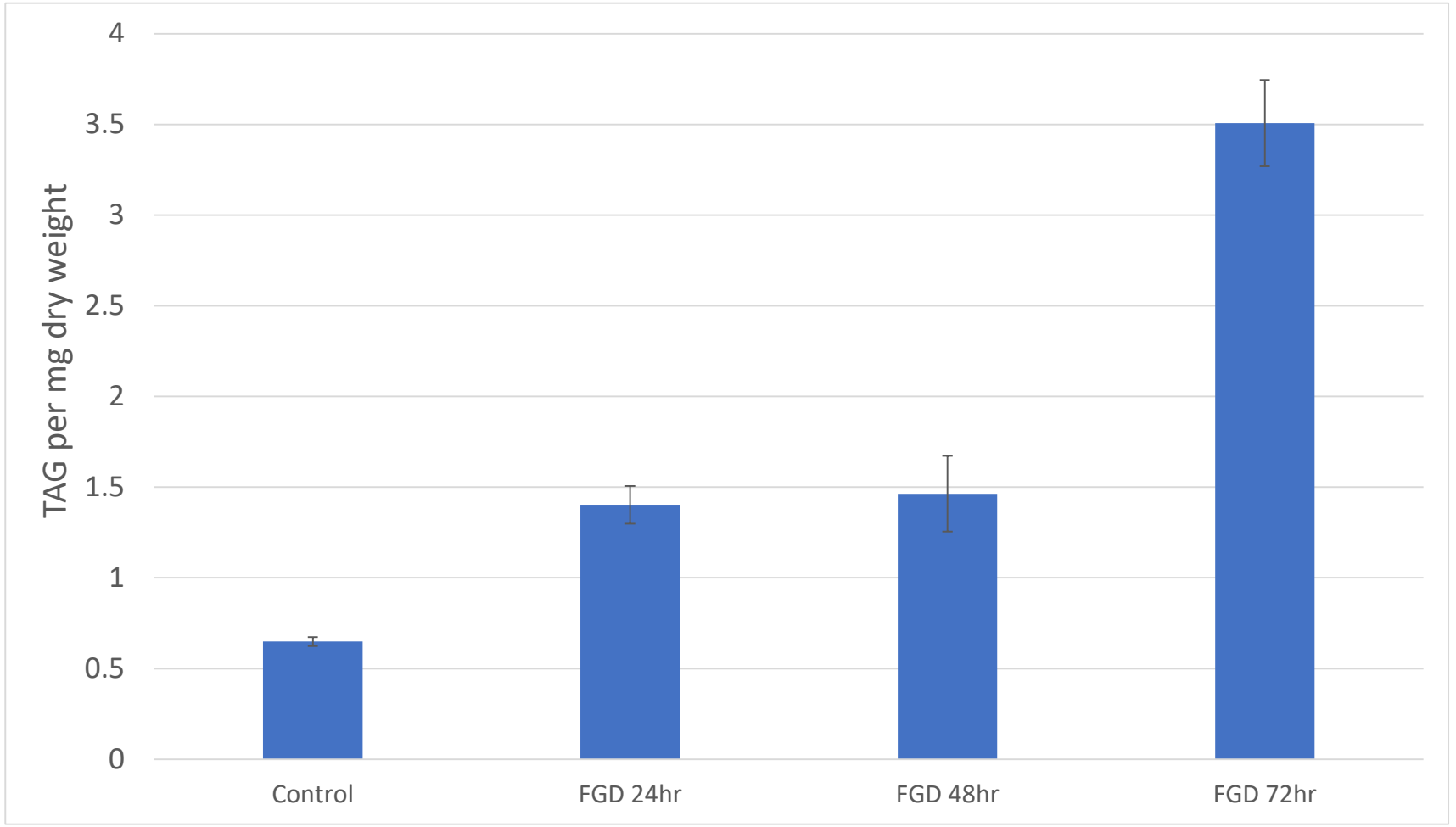
Treatment of Duckweed with FGD wastewater increases weight

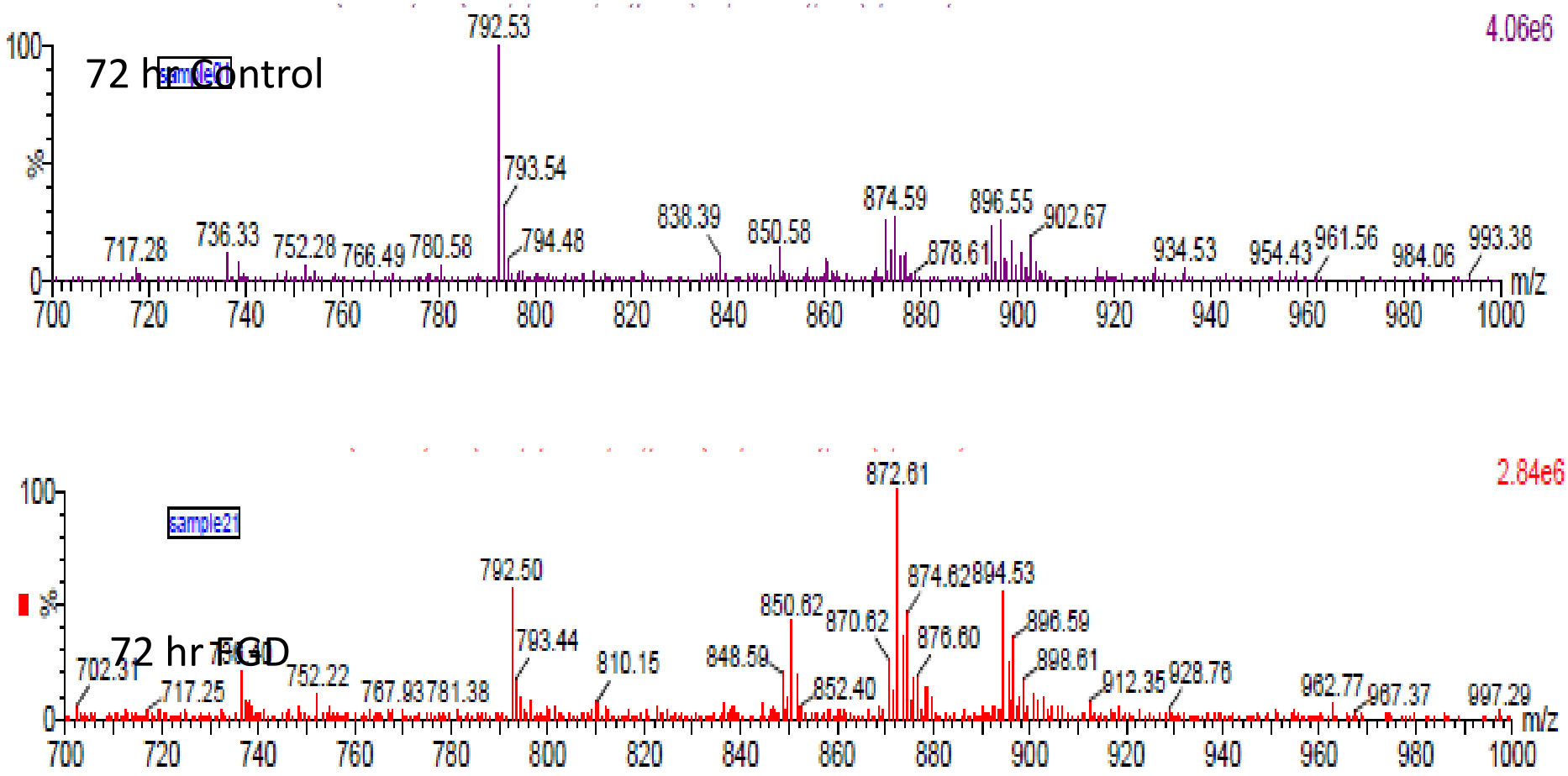


Effect of FGD Wastewater on Lipid Production in Duckweed



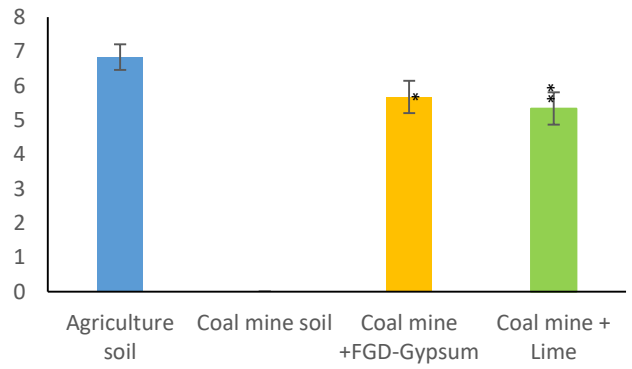
Quantification of Total TAG content in Duckweed using GC/MS



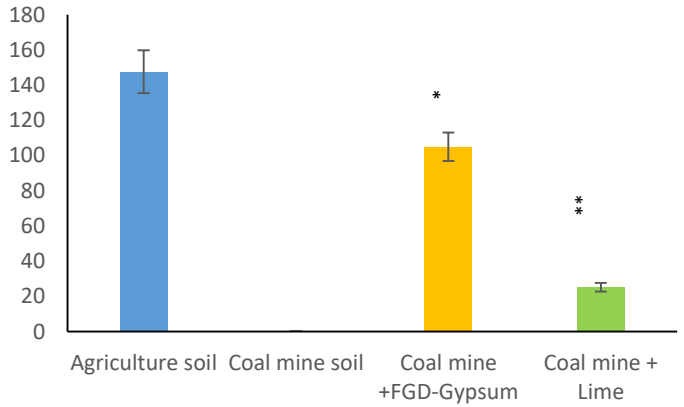

72 hr Control
4.06e6
100
%
0
792.53
793.54
794.48
717.28
736.33
752.28
766.49
780.58
838.39
850.58
874.59
878.61
896.55
902.67
934.53
954.43
961.56
984.06
993.38
m/z
700
720
740
760
780
800
820
840
860
880
900
920
940
960
980
1000
72 hr FGD
2.84e6
sample21
872.61
792.50
874.62
894.53
850.62
870.62
876.60
896.59
793.44
810.15
848.59
898.61
702.31
717.25
752.22
767.93
781.38
852.40
912.35
928.76
962.77
967.37
997.29

Different yield parameters of the plant grown on the control agriculture soil and coal mine soil blended with the FGD gypsum and lime.

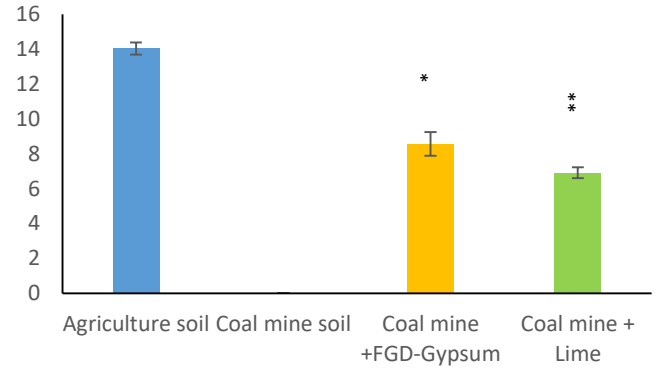
A



B

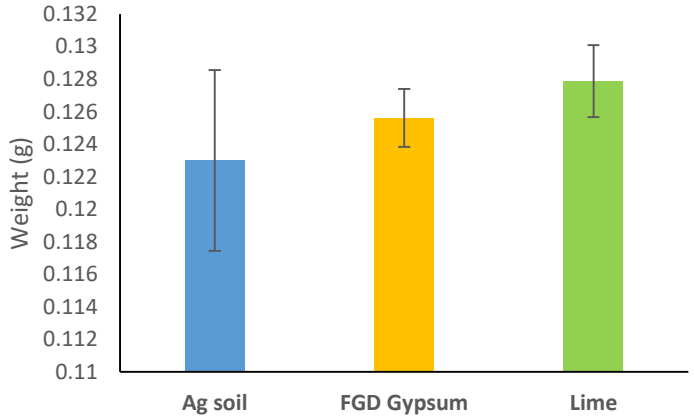


C



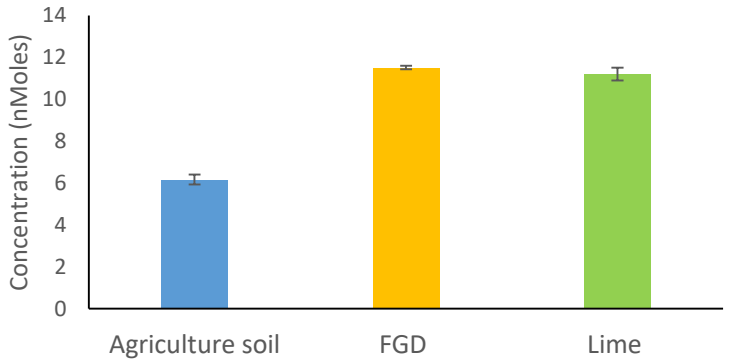
D

E

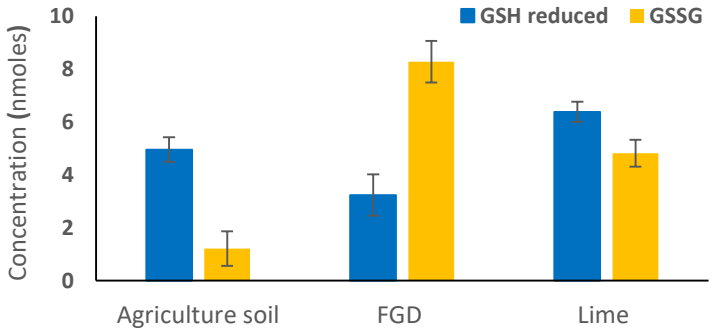


Quantification of Glutathione, a defense mechanism to an heavy metal and abiotic stress

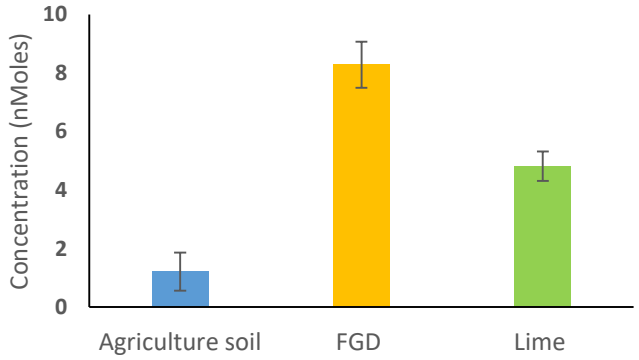
A



B



C



Concluding Remarks

(1-2 Slides)

- Completed the RNA Seq experiments for duckweeds treated with FGD wastewater for different time course and identified candidate genes involved in fatty acids and metal sequestration.

- Demonstrated the re-use of FGD wastewater in Agriculture on coal mine soils using bioenergy crop.