*Please submit this completed application and any relevant supporting documentation to* [*Sustainability-Committee@Illinois.edu*](mailto:Sustainability-Committee@Illinois.edu)*. The Working Group Chairs will be in contact with you regarding any questions about the application. If you have any questions about the application process, please contact the Student Sustainability Committee at* [*sustainability-committee@illinois.edu*](mailto:sustainability-committee@illinois.edu)*.*

# General Information

**Project Name:** Environment-friendly phosphorus filter from fly ash

**Total Amount Requested from SSC:** $8,000

**Project Topic Area(s):** Energy Education Food & Waste

Land Water Transportation

# Contact Information

Applicant Name: Rabin Bhattarai

Unit/Department: Agricultural and Biological Engineering

Email Address: rbhatta2@illinois.edu

Phone Number: 217-300-0001

**Project Team**

|  |  |  |
| --- | --- | --- |
| **Name** | **Department** | **Email** |
| Name | Department/Organization | Email Address |
| Name | Department/Organization | Email Address |
| Name | Department/Organization | Email Address |
| Name | Department/Organization | Email Address |

# Project Information

Please provide a brief background of the project, the goals, and the desired outcomes:

*Background*: Subsurface (tile) drainage has helped to sustain the productivity of our farm lands by draining excess water from the field. Excess nutrient losses from our tile-drained agricultural fields have contributed to several water quality issues in the region including the formation of hypoxic zone in the Gulf of Mexico. It has been well documented that tile drainage is responsible for highly soluble nitrate loss but recent studies have demonstrated that it also contributes to dissolved phosphorus loss from the agricultural fields. Phosphorus (P) has been recognized as the limiting nutrient for eutrophication in most freshwater systems. Filtration is the the most common way to remove P from contaminated water. Natural materials and industrial byproducts such as blast furnace slag, iron oxide tailings, coconut shell-activated carbon, flue gas, zeolite, goethite, bone char, biochar have been frequently used to facilitate P removal via sorption and precipitation. Fly ash is another potential P filter material since it is rich in Ca, Fe, and Al oxides. One potential problem with the use of fly ash is heavy metal leaching.

*Goals*: We aim to develop ceramic pellets using fly ash and other additives with minimum or no heavy metal leaching. The *specific objectives* of this proposed research project are to: a) optimize the proportion of fly ash and other additives for high P removal with no heavy metal leaching, and b) conduct laboratory experiments to analyze the performance of pellet for dissolved P reduction.

*Outcomes*: The outcome of this research will provide multiple environmental and educational benefits such as reduction in fly ash disposal to the landfill, improved water quality due to reduction in phosphorus pollution, and preparing future generation of scientists and engineers who are well versed in the area of pollution control. Since the results from this research will also be incorporated into the existing curriculum, future students will also benefit from this research.

Please provide a brief summary of how students will be involved in the project:

Exposing undergraduate students to research is one of the most effective mechanisms for encouraging the pursuit of scientific careers. Hence, two undergraduate students will be recruited to work on the project as undergrad hourly. They will be responsible for the project activities including setting up and conducting experiments, and writing report/scientific article under the guidance and supervision of Dr. Bhattarai. They will also present the project result at the ExploreACES in spring 2018. They will also be encouraged to compete in undergraduate research symposium both on and off campus.

Please provide a brief summary of the project timeline:

The duration of the proposed project will be three semesters (fall 2017, spring 2018, and summer 2018). During fall 2017, experiments will be conducted to improve flay ash pellet efficiency in P removal by varying the constituents to increase surface area and reduce heavy metal losses. In spring and summer 2018, laboratory experiments will be conducted to evaluate the performance of fly ash pellets in removing soluble P.

Additional comments

Request for no-cost extension for the summer 2018: We have made a new batch of fly ash pellet this spring with the help of an undergraduate student but did not have time to evaluate it. As I was also able to leverage the support from other sources for this work and I still have budget left over from SSC support. I am planning to recruit an undergraduate to work over the summer to do P absorption and desorption tests. Therefore, I want to request for a no-cost extension of the project until August 31, 2018.