Novel Material for Removal and Recovery of Phosphorus

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Problems: P Contamination

Environment

Wildlife/plants

Recreation

- Phosphate is a common water contaminant, especially in farm run-off
- Excess nutrients in water ways leads to algal blooms and excessive plant growth (some blooms toxic to humans)
- At first plant growth may be stimulated, but over time excessive plant growth can choke the water way, and lead to death of the plants
- Low oxygen in waterways can occur and death of aquatic organisms
- Effects on economics of food and recreation

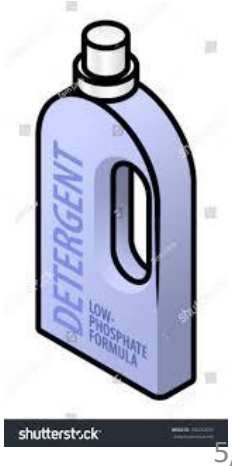
Contamination Sources

- **Agriculture**

- **Stormwater runoff**

- **Wastewater**

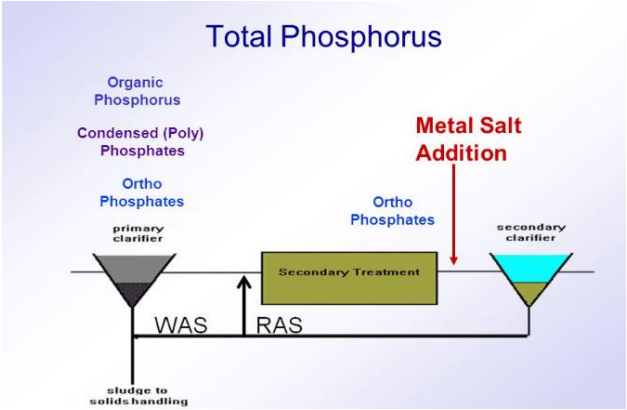
- **In and around the home**



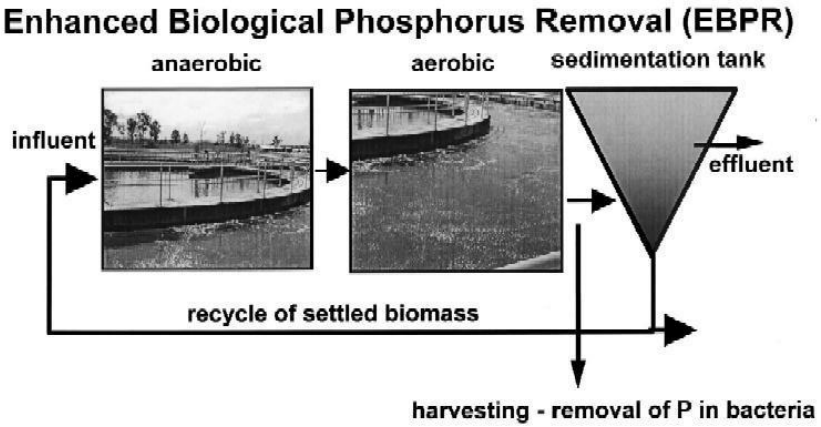
Problems in Phosphate Removal

- **Phosphorus treatment and removal technologies on the market:**

- **Chemical treatment**
- **Capital costs are lower than biological treatment, greater O&M costs than biological processes**



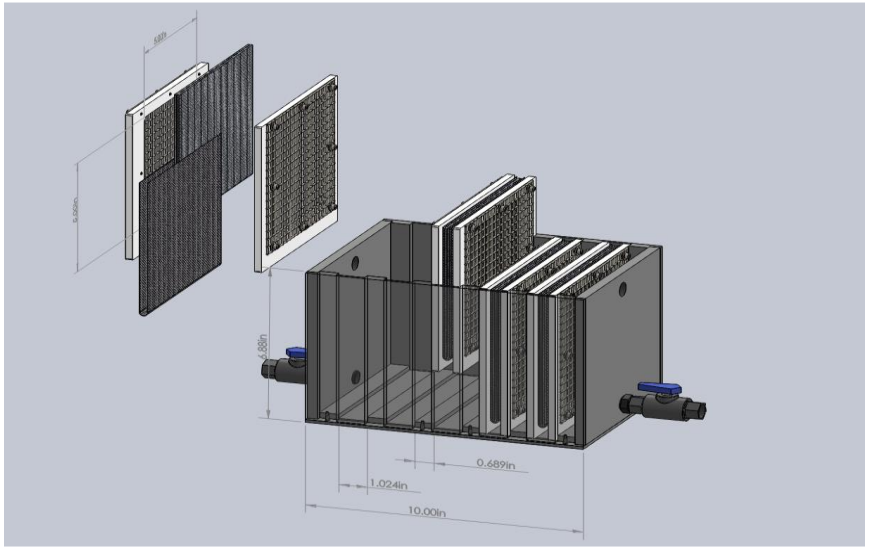
- **Biological treatment**



- **Zeolites**
  - **Difficult to recycle**
  - **Do not work in all environments**

Our Modified Zeolite Solution

- **Goldilocks solution**
  - **Stable**
  - **Works at wide range of pH**
  - **Tolerates high temperature**
  - **Recyclable**
  - **Flexible deployment**
  - **Quick adsorption of P**



(Inspiration was a furnace filter)
-Other deployment methods may also be used

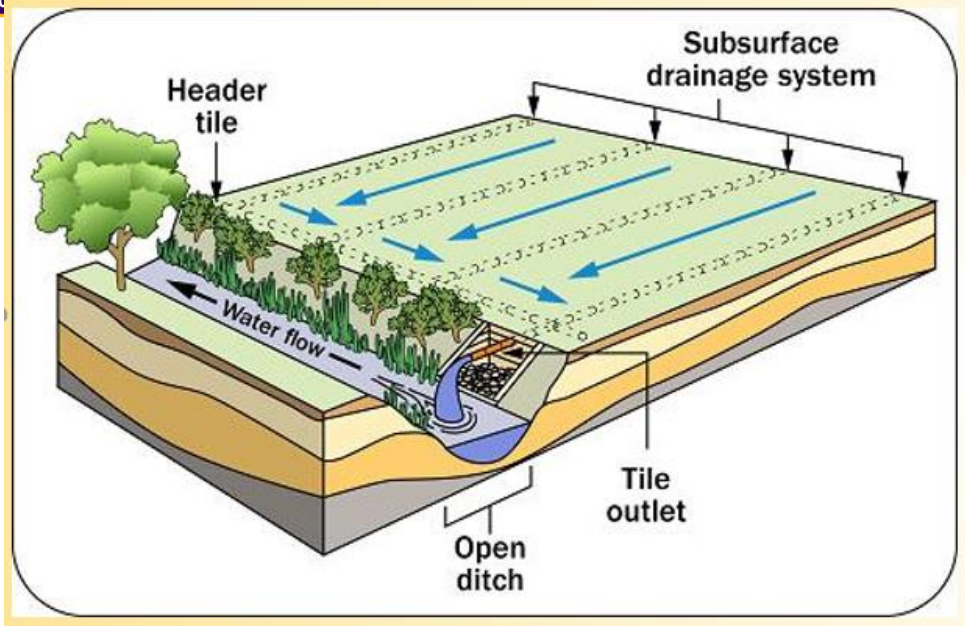
IP and Opportunity

- International Patent Pending: WO2017214530A1
- Looking for a development partner to aid in scale up and deployment for multiple applications
- Licensing is available

Market

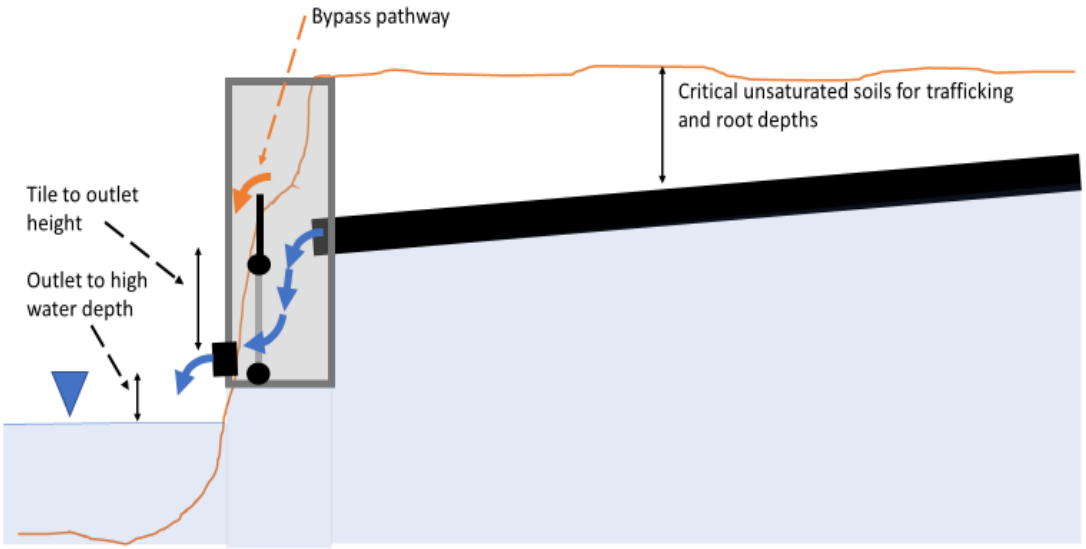
- **Our IP has potential in numerous markets including phosphate removal for wastewater/drinking water and the recovery and reuse/re-sale of phosphorus**
- About 90% of the world's mined phosphorus ends as the crucial ingredient in fertilizers
- The global phosphate market was valued at $67.3B in 2015 and is projected to reach $75.2B by 2021
- The global phosphate fertilizer market size was estimated at $51.6B in 2016

How the technology works



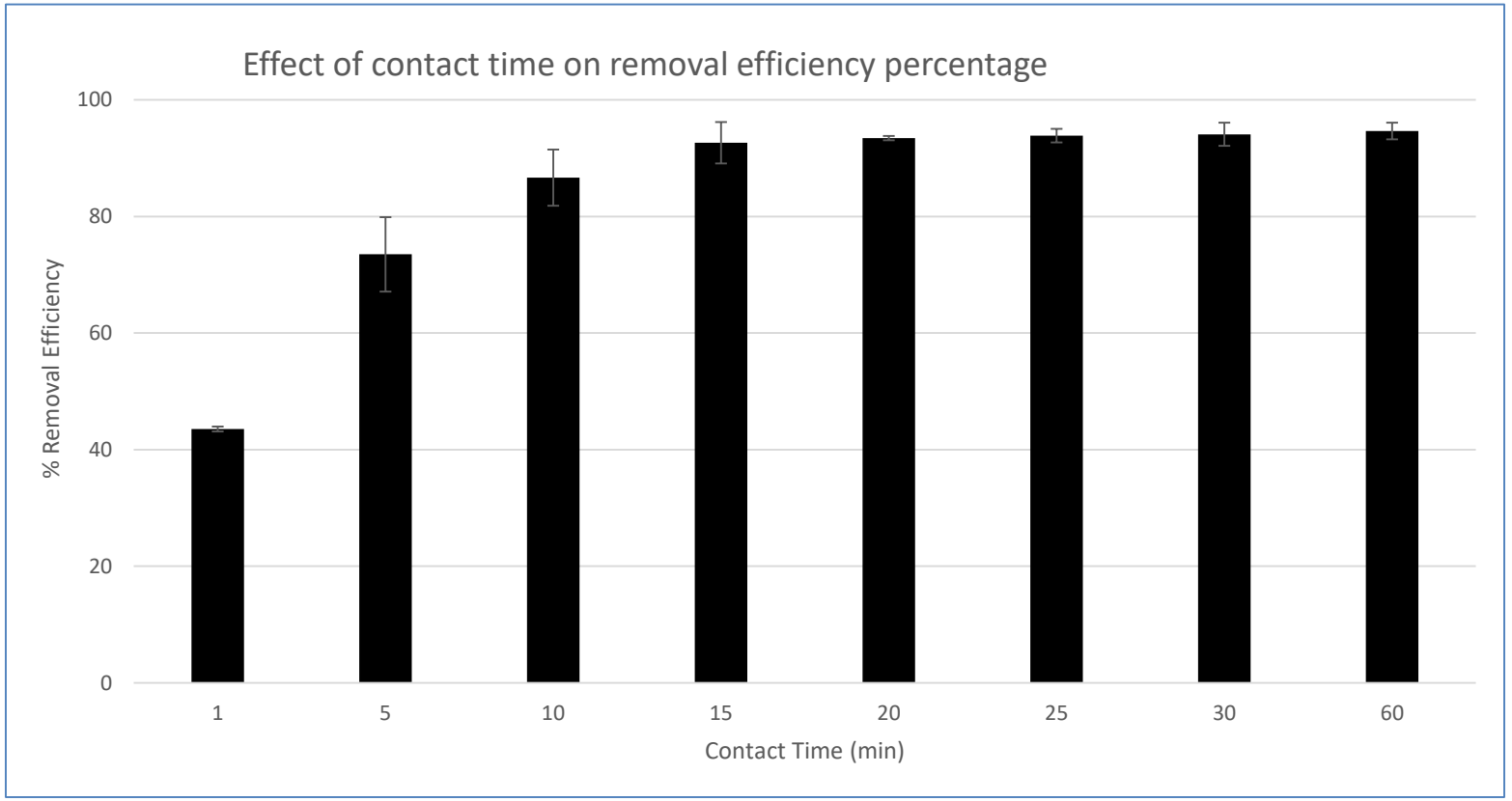
The Material:

- Zeolite functionalized with metal oxides such as lanthanum and magnesium to adsorb and remove P

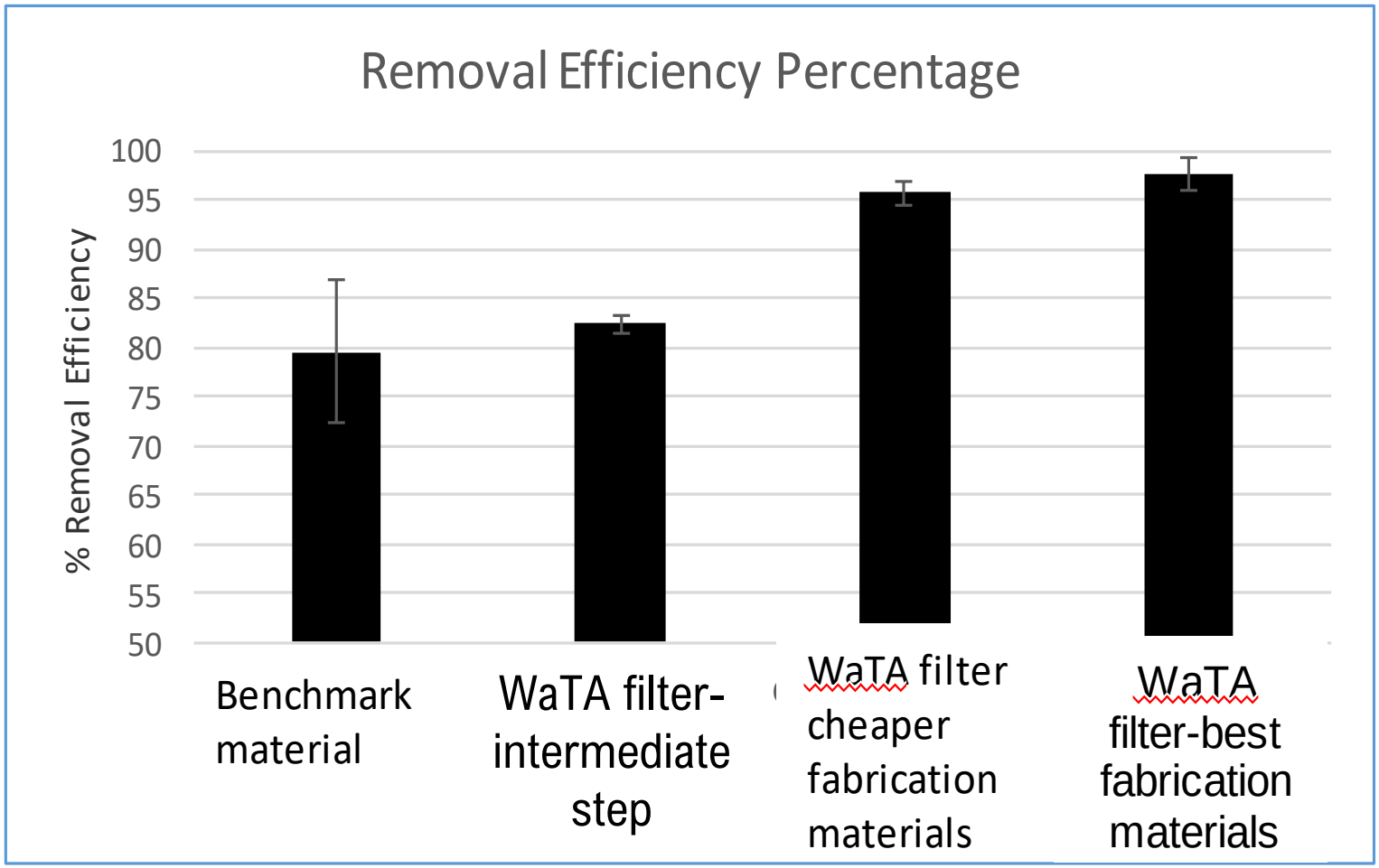


Our Modified Zeolite Solution

- **Quick adsorption of P**



Phosphorus Removal Efficiency



Comparison to other materials and our fabrication materials used

Regeneration Efficiency

- ✓**Plain zeolite**
  - **– removes 10 % P**
- ✓**Our modified zeolite -**
  - **– removes up to 98% P**
  - **– We can recycle modified zeolite 10 times and continue to remove P**

Next Steps

Current funding:

- ✓ **Great Lakes Protection Fund - $1.1 M ($450 K to UWM)**
- ✓ **Deployment of the system in farms in WI, MI and OH**
- ✓ **Monitoring of the system and performance by Dec 2019**

Looking For:

- **Partner to scale up,develop, and deploy in multiple markets**

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