

Arsenic Remediation with Dried Plant

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Phytoremediation has received increasing attention after the discovery of arsenic hyperaccumulation ability and growth habit plants which are able to accumulate, translocate, and concentrate high amount of certain toxic elements in their above-ground/harvestable parts.

Phytoremediation includes several processes namely, phytoextraction, phytodegradation, phytostabilization, and phytovolatilization.

Both terrestrial and aquatic plants have been tested to remediate contaminated soils and waters, respectively. A number of aquatic plants species have been investigated for the remediation of toxic contaminants such as As, Zn, Cd, Cu, Pb, Cr, Hg, etc.

Phytoremediation of contaminated arsenic in surface and groundwater (tube well) in Mekong Delta, Vietnam is a new idea. In the past, many researchers in the world have been tried to apply the characteristic property of terrestrial and aquatic plants as an arsenic-hyperaccumulating in root, tissue, and leaf. They used living plants submerged in the arsenic contaminated area and determined the concentrations of arsenic before and after the experiment.

For example, an arsenic-hyperaccumulating fern, commonly known as a fern (*Pteris vittata* L.), was grown hydroponically to examine its effectiveness in arsenic removal from what is believed to be herbicide-contaminated groundwater. One plant grown in 600 mL of groundwater effectively reduced the arsenic concentration from 46 to less than 10 $\mu\text{g/L}$ in 3 days. Re-used plants continued to take up arsenic from the groundwater, albeit at a slower rate (from 46 to 20 $\mu\text{g/L}$ during the same time). Young fern plants were more efficient in removing arsenic than were older fern plants of similar size.

In this research, we use the following dried plants:

- Water hyacinth – *Eichhornia crassipes* (Cây lục bình)
- Water Lily – *Nymphaeaceae* (Cây bông súng)
- Duckweed – *Azolla caroliniana* (Bèo hoa dâu)
- Duckweed – *Wolffia globosa* (Bèo cám)
- Fern – *Steris Vittata* (Cây dương xỉ)

These above plants came from various place in the U.S. and Vietnam (Xã Phong Mỹ, Huyện Cao Lãnh, Tỉnh Đồng Tháp). They were all sun-dried for three consecutive days with an estimated about 10% of humidity remaining.

Various experiments at different concentrations of arsenic standards (100, 150, 200, 300 and 400 ppb) together with different amount of dried plants (1, 2, 3 and 4gr) were conducted. In general, our results show some hyperaccumulation plant accumulate slightly more arsenic from contaminated water than other. During a series of seminars in Sydney, Brisbane, Melbourne and Adelaide Australia, many questions was raised about plant grown in U.S. vs. Vietnam, our conclusion is there's no different in arsenic removal. But overall, they all reduced the arsenic to acceptable level for drinking water at a quick rate.

Also, we tried to figure out an easy assemble (little to no cost) filter model which can remove arsenic in large quantity. With just a small pipe (2 inch in diameter by 2 feet in length) and 50 gr of dried plants, it can “treat” up to 12 liter of contaminated water by reduce the arsenic from 100 ppb to the required acceptance level at 10 ug/L.

In summary, there are many ways to reduce arsenic level in drinking water. Some method can cost more than other but using our prototype, people who live in rural area now can have a low cost method to combat arsenic in drinking water while we continue to find more effective ways.

However; the major challenge facing for our research team is how to help people living in Red River Delta and Mekong Delta in Vietnam to understand the danger of contaminated water in tube wells and in surface water as well as educate them to remove arsenic in their water.

- Do they know the danger of arsenic?
- Do they have the time to care where their daily life struggle is so difficult?
- Is the quality of drinking water their top priorities?
- **And once they do care, it's probably too late!**

The successful of this arsenic combatant can greatly increase with the support of local government.

What we can do now!

- Working together local authorities to identify and combat arsenic problems in affected areas
- Continue to discover more ways to reduce arsenic in drinking water
- Exchange our knowledge with the educators
- Educate our graduates and ask them to join us in our tasks
- Create awareness program and let our people know **we are here to help**
- And last, there is no money to be made in this project except the health of our people