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# CARBON DOTS HELP DETECT HERBICIDE POLLUTION

Relevant for: Environment | Topic: Environmental Degradation - GHGs, Ozone Depletion and Climate Change

Waste to wealth: Water hyacinth was used to produce carbon nanoparticles. | Photo Credit: M_Karunakaran

In an extraordinary waste-to-wealth feat, researchers from Assam have used the commonly found invasive plant water hyacinth to produce carbon nanoparticles. These extremely tiny (less than 10 nanometre) particles can be used for detecting a commonly used herbicide — pretilachlor. The nanoparticles were found to be selective and sensitive for the detection of the herbicide.

“At the biodiversity hub of our institute we have been trying to figure out how to convert this weed into a value-added product. Here in Assam, every water body is infested with water hyacinth, and it was an easy and cheap option to explore. Some teams are exploring if its fibre can be used to make furniture. We are also working on making activated carbon using the plant and these carbon dots were one of the innovations born in our lab,” explains Devasish Chowdhury from the Material Nanochemistry lab at the Institute of Advanced Study in Science and Technology, Assam. He is the corresponding author of the work published in *Heliyon.*

The team harvested water hyacinth leaves, removed the chlorophyll, dried and powdered it. The sieved powder underwent several treatments including heating at 150 degree Celsius to convert it to carbon dots. “When a nanoparticle is less than 10 nanometre we call it a dot or nanodot. Our carbon dots were able to give a green fluorescence under UV light. The extremely small oxygen functional groups on the surface of the dot are responsible for the fluorescence,” explains the first author of the paper Manash Jyoti Deka.

The herbicide pretilachlor is mixed with water and carbon dots, and studied using special equipment. The fluorescence intensity increases in the presence of the herbicide. The team also tested using different pesticides and other compounds having similar chemical structure and found that the carbon dot was extremely sensitive to pretilachlor and could detect even very small quantity of the herbicide. After successful testing in the laboratory conditions, the team collected soil samples from different places across the State and proved the efficiency of the carbon dots in detecting pretilachor in soil samples.

The paper also describes the mechanism by which electron transfer happens between the dot and the herbicide which enables the fluorescence enhancement. Dr. Chowdhury adds that this will be a commercially viable option when compared with the sensors currently available in the market, as the raw material for the construction of the sensor — the water hyacinth — is readily available and is practically a waste material. Based on this study, the group is now developing a paper strip–based sensor for on-site detection of pretilachlor.