doi:10.1038/nindia.2012.159; Published online 29 October 2012

Science news

Wood waste turned into plant booster

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Growth and productivity of plants can be enhanced by treating them with a type of carbon nano-material derived from wood waste, according to new research at the Indian Institute of Technology, Kanpur.

The researchers led by chemist Sabyasachi Sarkar claim to have improved the biomass and yield of gram plants (*Cicer arietinum*) by exposing the plants to a water soluble version of 'carbon nano-onions' or CNOs.[1] "This new nano-technological prospect of carbon nanoparticles could be used in the field of agriculture as a ubiquitous, benign growth-promoter," they report.

Wood wool from carpentry shops yields carbon 'nano-onions' that could promote plant growth.

The CNOs are concentric layers of pure carbon — one atop the other — which measure up to seven nanometres across and consist of about 10 shells (a nanometre is a billionth of a metre). Due to their layered design and small size these are called nano-onions.

Sarkar and co-workers obtained water soluble CNOs (wsCNOs) by subjecting 'wood wool', a waste product from carpentry shops, to a process called pyrolysis — thermal decomposition in the absence of oxygen. They treated the gram plants with the wsCNOs, grew them for 10 days in the laboratory and then transplanted the baby plants to soil. Untreated plants were used as control.

"We observed an enhanced growth rate of the wsCNOs pre-treated plants in comparison to untreated plants, which finally led to an increased productivity of plants in terms of a larger number of grams," Sarkar told *Nature India*. The scientists also observed an increase in the percentage of carbon and hydrogen in shoots suggesting that the treated plants were able to synthesize more organic biomass. "Thus, the carbonized wood at its nano-domain acts as a promoter to increase the growth of plants," Sarkar said. "In other words, wood itself acts as a growth stimulant of plants indirectly and thereby increases the biomass of the plant."

The researchers admit their finding only confirms the wisdom of Indian farmers who burn straw and dried grass in crop fields after each harvest. The essence of such a practice, according to Sarkar, is that the CNOs in the charred straw act as overall growth promoters for the next crop.

The scientists used electron microscopy to investigate the fate of the wsCNOs taken up by the plant by analysing thin sections of the roots. They found that the absorbed wsCNOs, were embedded throughout the 'xylem', the vessels responsible for the transportation of water and food from the roots to other parts of the plant.

Explaining the mechanism for CNOs ability to promote growth, the report said this may be directly related to the spongy surface of these wsCNOs, "which allows them to retain micronutrients and water, so that when distributed in the xylem to regulate the flow of fluid, the wsCNOs slowly release micronutrients through their porous exterior walls."

There have been only a few investigations on the effects of the active uptake of carbon nanomaterials by plants. Most of these studies, the team says, were carried out with different versions of carbon nano-tubes insoluble in water. Moreover, a full life-cycle of any plant — from germination to seed formation — under the exposure of CNOs has never been carried out till now, and the IIT scientists' work is the first of its nature.

The researchers conclude that their work shows that a large scope exists to investigate the impact of carbon-based materials as promoters in the development of plant systems.

References

1. Sonkar, S. K. *et al.* Water soluble carbon nano-onions from wood wool as growth promoters for gram plants. *Nanoscale*. doi: **10.1039/c2nr32408c** (2012)

Nature India EISSN 1755-3180 Header image source: Getty