Phytoremediation mediated airborne polycyclic aromatic hydrocarbons (PAH) management

By

Shubhra Singh

Patanjali Research Institute, Haridwar (India)

Polycyclic aromatic hydrocarbons PAHs such as naphthalene, phenanthrene, anthracene and pyreneare widespread environmental pollutants that are formed during hydrocarbon combustion. PAHs have been listed as major pollutantdue to their toxic, mutagenic and carcinogenic properties, which could be a serious threat to the ecosystem and similarly to the human health.

Air pollutants act as an abiotic stress in plants and they fix these pollutants by several mechanisms. A preliminary survey of the *Arabidopsis* genome suggests almost 700 genes encode proteins, which act directly on environmental pollutants. The molecular knowledge revealed abiotic stress leads to cell death and necrosis of tissues. In addition, stress response to PAH increase the expression of some of antioxidant enzymes like peroxidase, APX (ascorbate peroxidase), CAT (catalase), POD (peroxiredoxins) as well as superoxide dismutase leads to hydrogen peroxide accumulation. Plant cell maintain their homeostasis through antioxidant compounds and stress hormones. Subsequently, it produces ROS (reactive oxygen species) and creates an endogenous oxidative stress leading to PCD. Therefore, it is necessary to design a genetically modified plant, which can ideally eliminate or fix polycyclic hydrocarbons with the ultimate goal of bioengineered phytoremediation plant system. Genes that determine the characteristic of being able to decompose hazardous substances in nature can be inserted into plasmid DNA, transferable from other organisms by transformation or through recombinant DNA technology. Integrating these data could help in designing transgenic plants for PAH remediation. Some of the popular plants used for phytoremediation are spider plants (*Dracaena deremensis, Philodendron*), *Schefflera arboricola,* and some tree species like *Populus*, *Pinus*, *Betula pendula*, *Fraxinus* etc. In summary, we can use genetically modified plants to fix air-pollutants and to improve air quality in a shorter period. The rationale of this study is to collate and combine new avenues for improving plant resilience and PAH phytoremediation.

Fig1: Diagrammatic representation for generation of PAH remediation transgene.

