



## Applications of Nanotechnology in Agri-Food Sector

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### INTRODUCTION

Nanotechnology is a novel, innovative, interdisciplinary scientific approach that involves designing, development and application of materials & devices at molecular level in nanometer scale i.e. at least one dimension ranges in size from 1 to 100 nanometers. A billionth of meter. It is a broad spectrum emerging field of science which has brilliant applications in basic and applied sciences. It will leave no field untouched by its captivating scientific applications and agriculture sector is no exception. The use of nanotechnology in agriculture is getting importance because it's possible advantages vary from enhanced food values, reduced agricultural inputs, improved nutrient contents and longer shelf life.

#### Nano scale carriers

These are “smart” nano scale devices which can be deployed for the efficient delivery of fertilizers, herbicides, pesticides and plant growth regulators etc. The nano scale carriers are designed in such a way that they can anchor the plant roots to the surrounding soil and organic matter. Hence leading to improve stability against degradation in the environment and ultimately reduce the amount to be applied.

#### Nano-pesticide

Plant pests are major factors in limiting crop yields. Conventional pest controlling methods include the use of over-the-counter pesticides in large quantity which consequently add an additional cost in crop production. Excess amount of pesticides also cause environmental and water pollution. There is a need to use as much as minimum amount of pesticides to save the environment and reduce the cost in crop production. It can be achieved by increasing the retention time of pesticides with required efficiency.

A nanotechnology approach, “nano-encapsulation” can be used to improve the insecticidal value.

In nano-encapsulation technique the nano-sized active pesticide ingredient is sealed by a thin walled sac or shell (protective coating). The efficacious approach in this regard is “controlled release of the active ingredient” that would greatly improve effectiveness and decreased amount of pesticide input and associated environmental hazards. For example “Halloysite” (Clay nanotubes) have been developed as cost effective carriers of pesticides. These will greatly reduce the required amount of pesticides as having extended release time and better contact with plants, reducing the cost of pesticides up to a great extent with minimum impact on environment. Another improvement in this sense might be the availability of nano-structured catalysts which will increase the efficiency of pesticides and insecticides and also reduce the dose level required for plants.

#### **Nano-herbicides for effective weed control**

Weeds are big hazard in agriculture, they reduce the yield up to a great extent. So there is no other option except eradicating them. Nanotechnology has potential to get rid of weeds by using Nano-herbicides in an eco-friendly way, without leaving any toxic residues in soil and environment. Less amount of herbicide will be used if active ingredient is combined with a “smart” delivery system. Having size in nano dimensions, these will blend with soil particles and prevent the growth of weed species that have become resistant to conventional herbicides. Herbicides available in the market are designed to control or kill the above ground part of the weed plants. None of the herbicides inhibit activity of viable underground ground plant parts like rhizomes or tubers, which act as a source for new weeds in the ensuing season.

#### **Disinfectants**

It is estimated that 30 to 40% of the food produced on earth goes to waste before it can

be consumed. The situation is even worse in case of fruits and vegetables. These losses can be reduced up to great extent by increasing the shelf life of perishable commodities. Nano-particles can also be used as disinfectants in food packaging and food engineering to increase the shelf life of food products.

### **CONCLUSION**

In agriculture sector, Nanotechnology has phenomenal potential to facilitate and frame the next stage of precision farming techniques. It will increase agricultural potential to harvest higher yields in eco-friendly way even in challenging environment. Globally many countries have recognized the potential of nanotechnology in the agri-food sector and are investing a significant amount on it. The adoption of nanotechnology would play a crucial/ unparalleled role to feed the ever increasing population with declining natural resources.

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