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Nanomaterials for Environmental Remediation

Monitoring, Protection, and
Sustainability

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Environmental safety assessment and the fate of nanoagrochemicals

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19.1 Introduction

Numerous issues in agriculture and the environment, including urbanization, limited resources and energy availability, resource sustainability, run-off, and pesticide and fertilizer buildup, have the potential to be impacted by nanotechnology. With a continually expanding population, there is a need for greater agricultural yields as well as more efficient methods to maximize wise farming practices. Agronanotechnology has a significant influence on the development of precision agriculture and sustainable farming (Bala et al., 2022). By keeping an eye on environmental factors and taking focused action, this approach attempts to increase agricultural output (i.e., crop yields) while decreasing input (i.e., fertilizers, pesticides, and herbicides). Due to their ability to reduce the quantity of chemical products used and minimize nutrient losses while improving seed germination, growth, and crop protection through the sustained release of agrochemicals (Chaudhary et al., 2020; Rathna et al., 2018). Additionally, nanomaterials in agriculture may offer ground-breaking ways to safeguard and improve soils and water, increasing food output and quality globally while also being environmentally benign. The top makers of agricultural chemicals are all actively investigating the application of nanotechnology in agriculture. Over the past 10 years, a number of businesses have already filed patent applications containing a variety of procedures for the creation and use of nanopesticide formulations (Kim et al., 2018).

Although nanomaterials provide potential in a variety of scientific and technological fields, they also entail inherent hazards that are now unknowable (Mazari et al., 2021). Plants are protected by nano-formulations in agriculture from a variety of biotic and abiotic threats, and this has greatly enhanced agricultural productivity. Despite the obvious benefits of employing nanoscale materials, there are still open issues about the possible negative environmental impacts of nanoparticles (Grunwald, 2020). One of the biggest problems that has to be solved in the near future, before nanomaterial production becomes widely used, is how dangerous they are to people