Chapter 13
Nano Particles and Their Mode of Action in Environment

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ABSTRACT
Nano particles are particles that exist on a nanometer scale. Nanoparticles exist in our surrounding either naturally or created by human activities. As per Commission of European Union (2011), a nano-object needs only one of its characteristic dimensions to be in the range of 1-100nm to be classed as a nanoparticle even if its other dimensions are outside that range. Nanoparticles have revolutionized the world through the introduction of a unique class of material and consumer products in many fields due to production of innovative materials and devices. Despite their unique benefits and utility in daily activities, this could result in undesirable changes in the environment and affect the workplace. Carbon-based nanoparticles, oxides of metals, and natural inorganic compounds can have biological effects on the environment and human health. This chapter deals with the nanoparticles and their mode of action in the environment.

INTRODUCTION
The term nano originated from the Greek nanos which means ‘dwarf. It is one billionth of a meter. Within the convention of International System of Units (SI) it is used to indicate a reduction factor of 10^9 times. So, in nano world the measurements are done on nano meter scale which is represented as 1nm is equals to 10^-9 m. There are various nano containing terms which we can listen around our surrounding but most published one is the nanotechnology that occur frequently in scientific reports, in popular books as well as in newspapers and that have become familiar to a wide public, even of nonexperts (Ranjit, k. et al., 2013). The idea of nanotechnology was first introduced in the 1959 by Richard Feynman in his lecture entitled “There’s Plenty of Room at the Bottom”. At that time, the term nano technology was under it first phase of development. This technology made a significant and rapid progress years later (Majeed, DOI: 10.4018/978-1-5225-3126-5.ch013
Nanotechnology is the use of very small particles of material either by themselves or by their manipulation to create new large scale materials. Nanotechnology is not a new science and not a new technology in existence, it is just an advancement of sciences and technologies that have already been in development for many years. It is re-engineering of materials by controlling the matter at the atomic level.

The key in nanotechnology is the size of particles because the properties of materials are dramatically affected under a scale of nano meter as compare to bulk size materials. Also, as particles become nano-sized the proportion of atoms on the surface increases relative to those inside and this provides an unique properties, which is beneficial in term of construction of lighter and stronger structure as construction point of view, manufacturing of electronics devices in order to reduce their weight and power consumption. It can also be used to provide an alternative source of fuel against available conventional fuel sources such as diesel and gasoline by making the production of fuels from low grade raw materials economically with increase the mileage of engines and soo on (Sabihuddin, S., 2014). There are thus endless possibilities for improved devices, structures, and materials if we can understand these differences, and learn how to control the assembly of small structures. Nanostructure objects with nanometer scale features are not new and they were not first created by man. There are many examples of nanostructures in nature in the way that plants and animals have evolved. Similarly there are many natural nano scale materials, such as catalysts, porous materials, certain minerals, soot particles, etc., that have unique properties particularly because of the nanoscale features. Researches and analysis in the field of nanotechnology have enabled us to begin to understand and control these structures and properties in order to make new functional materials and devices [(Rathbun, L. et al., (2005)].

Nanoparticle

Nanoparticles are particles with at least one dimension smaller than 1 micron and potentially as small as atomic and molecular length scales. Nanoparticles can have amorphous or crystalline form and their surfaces can act as carriers for liquid droplets or gases. Examples of materials in crystalline nanoparticle form are fullerenes and carbon nanotubes, while traditional crystalline solid forms are graphite and diamond [(Report on Nanotechnology and Construction, (2006), and ECH& CPDG, Public Health and Risk Assessment, (2006)].

Differences Between Nano Scale Materials and Bulk Materials

Two primary factors, which cause nanomaterials to behave significantly different than bulk materials:

1. **Surface Effects:** Due to the fraction of atoms at the surface.
2. **Quantum Effects:** Showing discontinuous behaviour due to quantum confinement effects in materials with delocalized electrons.

These factors affect the chemical reactivity of materials, as well as their mechanical, optical, electric, and magnetic properties.

The fraction of the atoms at the surface in nanoparticles is increased compared to microparticles or bulk materials. Nanoparticles have a very large surface area and high particle number per unit mass as compared to microparticles.