

Data Dictionary

1. The term nanopesticide comprises a great variety of products covering a wide range of properties and levels of development,
2. According to Ria Koorana “Nanopesticides are plant protection products where nanotechnology is employed to enhance the efficacy or reduce the environmental footprint of a pesticide active ingredient,
3. active ingredients (AIs) are the major component for the formulation for specific applications, and many existing agrochemical formulations unintentionally contain structures in the nanometer size range
4. Nanopesticides “involve either very small particles of a pesticide active ingredient (ai) or other small engineered structures with useful pesticidal properties”.⁽⁶⁾ For the purpose of this paper, we regard a nanopesticide as a plant protection product in which nano-technology
5. Hydrodynamic diameter hydrodynamic size measured by Dynamic Light Scattering (DLS) is defined as “the size of a hypothetical hard sphere that diffuses in the same fashion as that of the particle being measured”
6. Poydispersity Index: This index is a number calculated from a simple 2 parameter fit to the correlation data (the cumulants analysis). The Polydispersity Index is dimensionless and scaled such that values smaller than 0.05 are rarely seen other than with highly monodisperse standards. Values greater than 0.7 indicate that the sample has a very broad size distribution and is probably not suitable for the dynamic light scattering (DLS) technique. The various size distribution algorithms work with data that falls between these two extremes.
7. Nanopesticide have excellent properties and are being employed in a large number of commercial applications. The properties of MWNTs are:
 - Electrical: MWNTs are highly conductive when properly integrated into a composite structure. One must note that the outer wall alone is conducting, the inner walls are not instrumental to conductivity.
 - Morphology: MWNTs have a high aspect ratio with lengths typically more than 100 times the diameter, and in certain cases much higher. Their performance and application is based not just on aspect ratio, but also on the degree of entanglement and the straightness of the tubes, which in turn is a function of the both the degree and dimension of defects in the tubes.

- Physical: Defect-free, individual, MWNTs have an excellent tensile strength and when integrated into a composite, such as a thermoplastic or thermoset compounds, can significantly increase its strength.
 - Thermal: MWNTs have a thermal stability more than 600 °C, based on the level of defects and to certain extent on the purity as residual catalyst in the product can also catalyze decomposition.
 - Chemical: MWNTs are an allotrope of sp^2 hybridized carbon similar to graphite and fullerenes and as such have high chemical stability. However, one can functionalize the nanotubes to enhance both the strength and dispersibility of composites.
8. Aggregation of nanoparticles (NPs) in aqueous dispersions involves the formation and growth of clusters and is controlled by both interfacial chemical reactions and particle transport mechanisms.
9. Commercializing MWNTs have many challenges including the following:
- Dispersion: These have better dispersability into solutions or polymers than SWNTs, however the quality of the dispersion obtained is a critical factor in the performance of the final product.
 - Purity: Many MWNTs processes cause considerable residual metallic catalyst which can be detrimental to performance.
 - Defects: The number of defects is dependent on the number of layers within MWNTs. The high aspect ratio of MWNTs contributes much of the value of their use.
- 5, One of the potential applications of copper (CNT), its usage for pesticide Copper nanoparticles (NCu) have been used as an antimicrobial agent in agriculture. Therefore, NCu may interact with numerous pollutants including pesticides. Little is known about the combined effects of NCu and pesticides in soil.