Nanopesticides for sustainable agriculture: analytical approach for characterisation

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Nanotechnology is used in plant protection products (PPPs) for a more eco-sustainable agricultural production through the reduction of cost, waste and doses applied, leading to a decrease in environmental and human exposure. However, in order to assure a safe use of nanopesticides in the agri-food sector, future research must consider the specific nanoscale features that may pose novel risks. According to EFSA guidance prerequisite for risk assessment of nanomaterials is the unambiguous identification and detailed physico-chemical characterisation, that provide important pointers for potential toxicity. There are mainly two types of nanopesticides: (i) those in which the a.s. is conveyed by capsules, emulsions, particles or nanocarriers and (ii) those in which it is the same a.s. to have nano dimensions. In case of nanoformulated PPPs, the exposure assessment should consider that the nanoformulation may affect the fate in the crop as well as in animals and a specific risk assessment have to be performed. The development of analytical methods suitable for the detection and characterization of nanopesticides is a first step to allow a proper risk assessment. In the framwork of our project, a combination of advanced and complementary techniques (Dynamic Light Scattering (DLS), Field Flow Fractionation (FFF)-Multi Angle Light Scattering (MALS) Electronic Transmission Microscope (TEM) and Liquid and Gas chromatographic techniques coupled with Tandem Mass Spectrometry (MS/MS) or Diode of Array Detection (DAD)) has been adopted to determine physic-chemical properties of nanomaterials. This approach was applied to four kinds of formulations of PPPs (capsule, emulsion, dispersion, metals). The classification as nanomaterials was evaluated according to European Commission recommended definition. By applying this multi-faced analytical approach, the results revealed that examined PPPs are constituted by nano and sub-micron particles.