Natural proteinaceous nanoparticles for theranostic purposes

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Natural protein nanoparticles are presented as a great alternative for the development of tools in the biomedical field, providing advantages in terms of biosafety and biocompatibility. This kind of These nanomaterials has been are being used as diagnostic tools, drug delivery systems, vaccination vehicles, among others; so they are considered as a new set of theranostic tools. In this context, viral-derived nanoparticles, specifically those derived from plant viruses, offer an extra of biosafety because they are not human or animal pathogens, as well as interesting structural characteristics for tool development, and also cost-economy by plant molecular farming. This is the case of Turnip mosaic virus (TuMV), a potyvirus with whose particles exhibit a flexuous elongated structure which allows the development of functionalized nanoparticles with up to 2000 copies of different compounds with a biomedical interest.

Derivatization by chemical conjugation to different amino acid residues, located in specific regions of the particle surface [1], has allowed a designed functionalization of these particles depending on the application. This functionalization pathway strategy has allowed to conjugate different compounds, such as:

- Peptides with a diagnostic value, in this case related with an autoimmune inflammatory disease.
- Small proteins, like PruP3, a peach allergen with a molecular weight of 9 kDa [2].
- Fluorophores, for bioimagen diagnosis.
- Natural compounds with biomedical properties: antimicrobial, antitumoral and/or antiviral.

These functionalizated VNPs would be are used in different applications, such as antitumor treatments, antimicrobial systems, diagnosis of autoimmune diseases, or theranostic tools for food allergies.

Other approaches consisted of functionalization through genetic fusion of peptides to the virus coat protein (CP), rendering peptide-coated nanoparticles, deployable as tools for immunization [3], or for high sensitive diagnosis [3,4]; or the development of nanonets with immobilized enzymes, which has been shown as a possible potential useful tool in the pharmaceutical industry [5], allowing greater yields, for example, in racemic mixtures resolution.

All these advances are opening doors to the multifunctionalization of viral nanoparticles, where different functionalities are presented together and simultaneously in the same nanoparticle.

References

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Figures

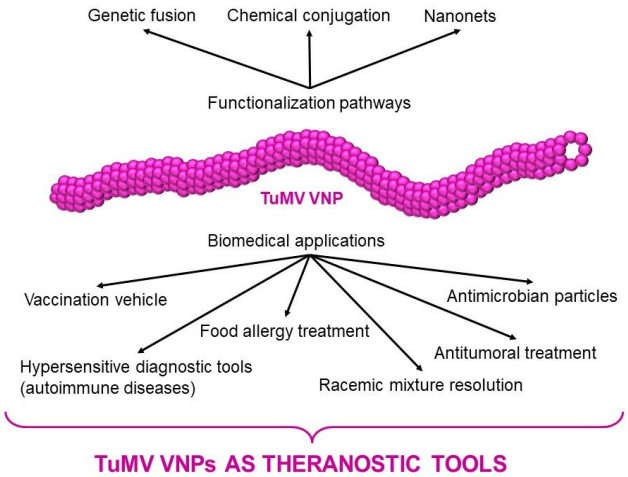

Figure 1. Functionalization and application of TuMV VNPs in the biomedical field as theranostic tools.