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PLANT VIRUS NANOPARTICLES FOR MOLECULAR DIAGNOSTICS APPLICATIONS

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Advances in nanotechnologies have led to the development of novel nanomaterials with potential applications in biomedicine, such as tissue-specific imagine, drug delivery and molecular diagnostic. Many different platforms have been developed, ranging from synthetic nanomaterials to natural occurring bio-nanomaterials, the latter including protein cages and viral nanoparticles (VNPs). VNPs are nanomaterials based on viruses, those natural occurring nanostructures have many unique properties, like self-assembling architectures that can easily produce in milligram quantities in laboratory scale or a quality controls system that guarantees that all the particles are monodisperse and nearly identical in shape and size, VNPs normally comes from virus capsids, those structures occur naturally in many different forms.

One common property shared by all capsids is their exceptional robustness, reflecting their natural function to enclose and protect viral nucleic acids, and because they are entirely composed of protein VNPs are also biodegradable and biocompatible. Furthermore, those particles are suitable for scale up production and industrial manufacturing, given their inexpensive production. Together, these features make VNPs one of the most advanced and versatile nanomaterials by nature.

Exploiting plant viruses to produce VNPs (pVNPs) gives a major advantage in terms of safety, they do not infect humans, given the proteinaceous composition of plant virus capsids, several production platforms are available, ranging from the traditional recombinant protein production systems based on bacterial fermentation, mammals, and insect cells coltures and transgenic animals, which present different drawbacks, from the high costs to the scalability and safety. Due to these reasons, in the past years the use of plants as a bioreactor to produce recombinant proteins has been widely used, in a process called Plant Molecular Farming (PMF). PMF encloses different advantages for example, the cost effectiveness due to the high scalability, the non-essential sterility, and the capability of plant to add Post Translational Modifications (PTMs). To overcome on of the major disadvantage of PMF, the low yields, a recent strategy to produce pVNPs is focused on the fusion of the recombinant with a structural viral protein, to expose the fusion protein on the virus surface; this system is particularly useful for the presentation of proteinaceous epitopes, antibodies, and peptides, making pVNPs particularly suitable for therapy and molecular diagnostics.

In this work the development of a new peptide display system, based on a non-infectious version *Alternanthera Mosaic Virus* (AltMV) is described, and as a final focus this nanomaterial will be modified for different application in molecular diagnostic for autoimmune diseases, like Rheumatoid Arthritis and Sjögren's Syndrome.