GREEN SYNTHESIS OF METAL NANORODS - EXPLOITING NOVEL BIOLOGICAL TEMPLATES: BARLEY STRIPE MOSAIC VIRUS VIRUS-LIKE PARTICLES

The synthesis of nanoscale materials of uniform morphology and monodisperse quality is of substantial interest recently. Biotemplating has become an emerging field in which natural biomolecular objects are utilized for creating functional, hierarchical, controlled patterned structures with nanometric precision. It is a capital effective, eco-friendly and energy-efficient synthetic process. Viral biotemplating has shown great potential in electronics, environmental and biomedical devices because of the features of precise dimension, diversity of architecture and the amenability to genetic/chemical engineering. A novel virus biotemplate, Barley stripe mosaic virus (BSMV) virus-like particle is designed and engineered through genetic engineering. The self-assembly of BSMV-VLP nanorod from an alternative microbial-based protein expression system without the restrictions of *in-planta* production was achieved for the first time. To further increase the stability of BSMV protein assembly, the virion assembly was decoupled into two governing internal protein interactions. By introducing mutations on selective carboxylate residues, the intersubunit protein interactions was significantly altered, resulting in an *in vivo* production of nucleic-acid free BSMV-VLP assembly for the first time. Finally, to demonstrate the versatile uses of BSMV-VLP in biotemplating, the new biotemplate was utilized to expand understandings on the directed synthesis of metal nanostructures. By using the hydrothermal synthesis, VLPs were successfully utilized to synthesize monometallic and bimetallic nanostructures with a wide range of length scales. The produced VLP-mediated nanorods are of good quality that are more uniformly and fully-covered than the ones synthesized with in planta-produced BSMV virion. Taken together, we have demonstrated the engineering and production of a novel BSMV virus-like particle bacterial system. This alternative platform and developed parameter space for VLP production is genetically tractable and requires a significantly shorter processing duration for large-scale mass production. The BSMV-VLP biotemplated metal nanomaterials present great qualities and controllable dimensions. This approach has explored the synthetic palette and opened up enormous possibilities in the bottom-up nanofabrication of versatile and tunable organic-inorganic nanoscaled complex and would facilitate future engineering industrial applications.