



# MESOPOROUS SILICA PARTICLE WITH A MYCOBACTERIAL SURFACE LIPID BILAYER

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## INTRODUCTION:

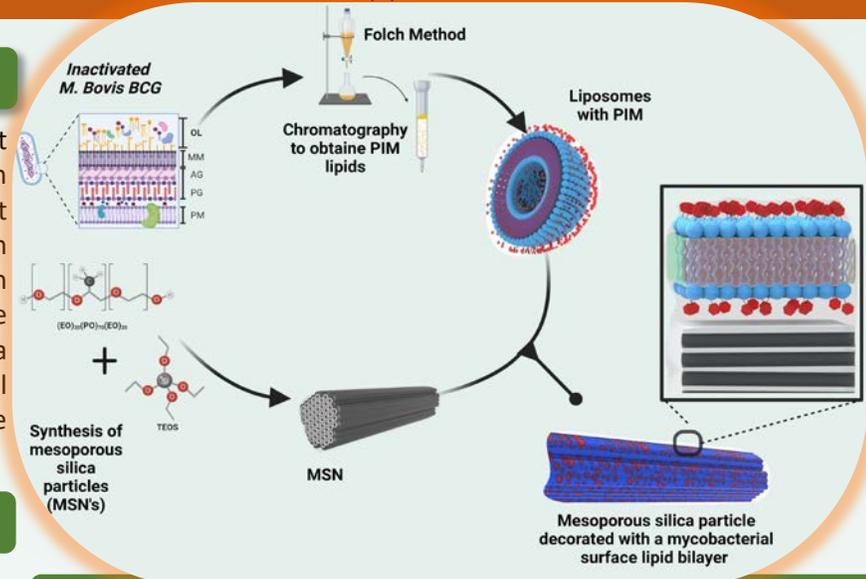
Vaccination has been proven to be one of our greatest weapons against infectious diseases. New generation vaccines using lipid nanoparticles have been approved against COVID-19 having great efficiency. Nanoparticles have been used in biomedical applications due to their easy modulation of properties including chemical composition, surface reactivity, and size. Here we investigated mesoporous silica particles known as SBA-15, decorated with a mycobacterial lipid, phosphatidylinositol mannoside (PIM), through the use of surface lipid bilayers.

## METHODOLOGY:

- PIMs were purified from mycobacteria and the lipid fraction containing PIMs was obtained by a chromatographic method.
- Liposomes were prepared for displaying PIM on their surface.
- Mesoporous silica particles were synthesized by tetraethyl-orthosilicate condensation in the presence of Pluronic 123, and cationized by functionalization with amino groups.
- Hybrid particles were prepared by self-assembly, and THP-1 macrophages were exposed to particles and analyzed by confocal microscopy. To observe the particles, a Rho-PE marker was used, as well as an anti-TLR-2 antibody and a secondary antibody with FITC to detect protein expression.

### References

K. Vijay, *Int. Immunopharmacol.* 59, 391 (2018).  
 Valdemar-Aguilar, C. M., Manisekaran, R., Avila, R., Compeán-García, V. D., Nava-Mendoza, R., & Lopez-Marín, L. M. *Biointerphases* (2020).

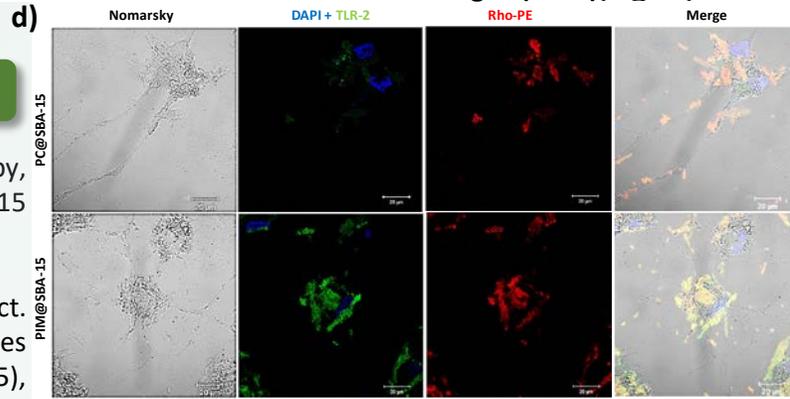
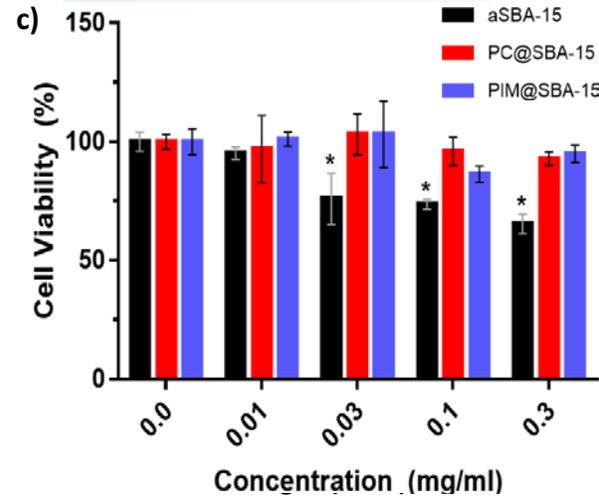
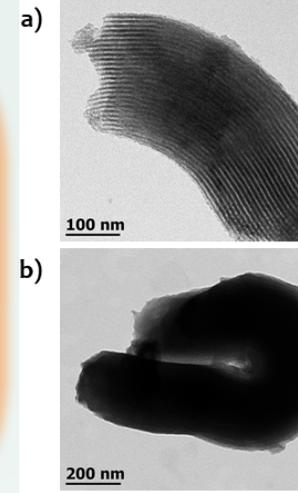


## RESULTS:

**a & b)** Hybrid particles (PIM@MSN) were characterized by electron microscopy, zeta potential and FTIR spectroscopy. Electron microscopy of a bare SBA-15 particle with typical nanochannels **a)** and a PIM-liposome coated particle **b)**.

**c)** An MTT assay was used to determine the biocompatibility of this new construct. No toxicity was found after human fibroblast exposure to increasing particle doses at 0.01, 0.03, 0.1 and 0.3 mg/ml of PIM-liposome-coated particles (PIM@SBA-15), and phosphatidylcholine liposome-coated particles (PC@SBA-15). Uncoated functionalized particles (aSBA-15) shows a cell viability decrease after 0.3 mg/ml concentrations.

**d)** PIM@SBA-15 particles colocalized with TLR-2 receptors from THP-1 derived macrophages. After a 6 hours incubation period with PIM@SBA-15, increase expression of TLR-2 receptors in THP-1 macrophages was observed. As a control, PC@SBA-15 were used under the same conditions, no over expression of TLR-2 receptors were observed.



## CONCLUSIONS:

These results encourage the exploration of PIM@SBA-15 particles as a mimetic system, capable of activating the innate immune system, and its possible use as an adjuvant for vaccination proposals.

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