A Microparticulate Vaccine Microneedle patch for pain free Immunization against Coronavirus disease

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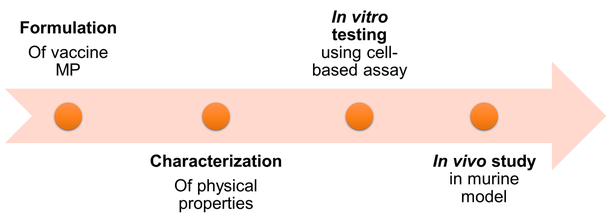
Introduction

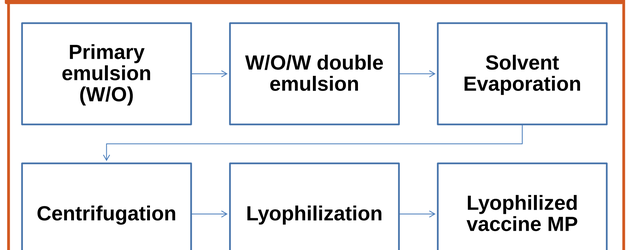
Coronaviruses cause mild to serious upper respiratory tract illnesses in both animals as well as humans. The novel pandemic strain, SARS CoV-2, which causes COVID-19, has become a serious global threat. This study aims to test the immunogenicity of a novel heat-inactivated coronavirus microparticulate vaccine administered via dissolving microneedles.

Objectives

- To formulate a microparticulate vaccine using heat inactivated coronavirus as the antigen.
- Particulate vaccines offer protection to the antigen resulting in several advantages such as better cellular uptake, antigen presentation and consequently increased immune response.
- To explore transdermal needle-free delivery of the microparticulate vaccine via a dissolving microneedle (MN) patch.



Methods



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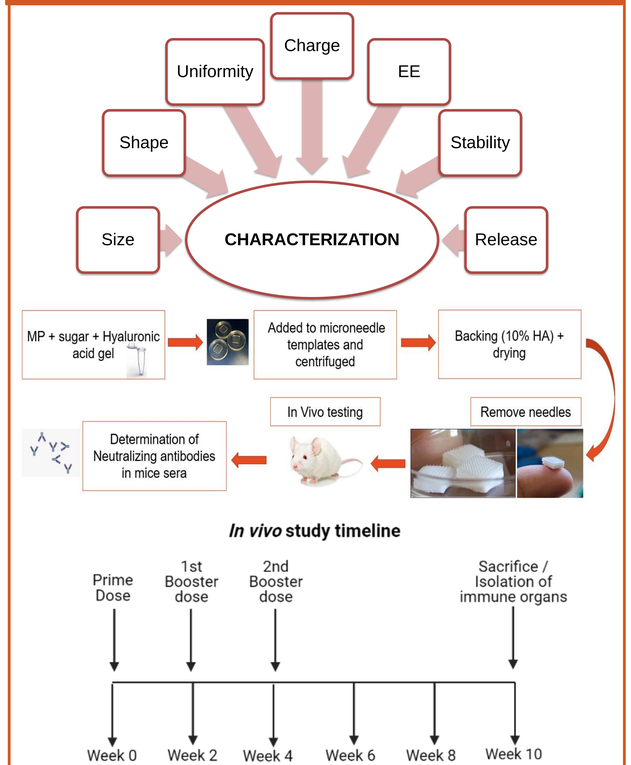


Results

Table: Characterization of Vaccine Microparticles

Yield (%w/w)	96.1 % w/w
Size (nm)	810 nm
Poly Dispersity Index (PDI)	0.70
Encapsulation Efficiency (EE)	> 80%

Results

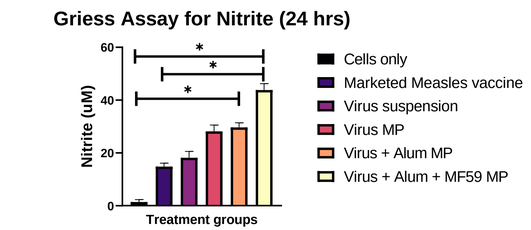


Figure1:Vaccine + adjuvant groups show a significantly higher ($p<0.05$) release of nitric oxide (NO) compared to untreated cells which is an indication of innate immune response

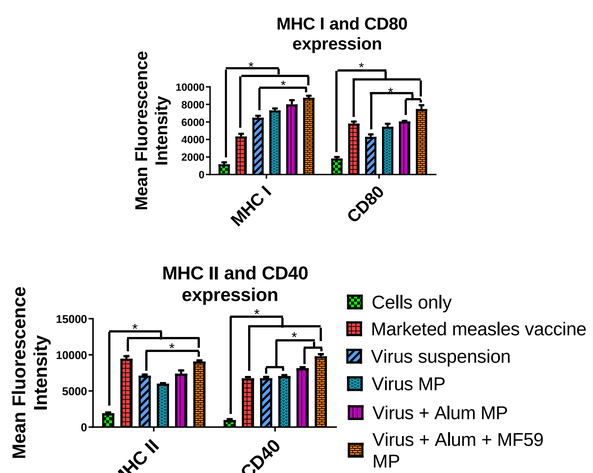


Figure 2:Flow cytometry analysis confirmed significantly higher expression of MHC I/CD80 and MHC II/CD40 on the surface of APC's compared to untreated cells. This indicates effective antigen presentation.

Results

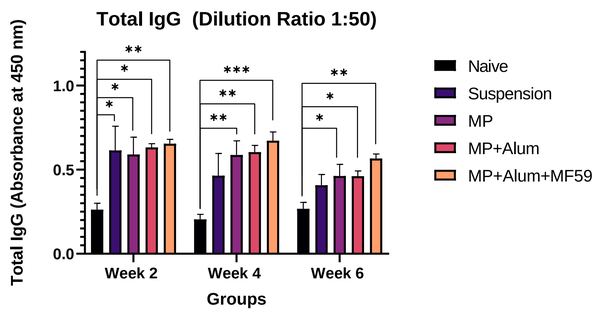
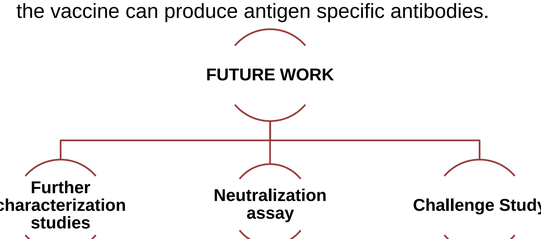


Figure 3:: Vaccine + adjuvant groups induced a higher level of IgG than the antigen suspension group.

Discussion

- The Microparticulate vaccine is stable, immunogenic and protective.
- The In Vitro results obtained confirm the ability of the vaccine MP to elicit a strong Innate as well as adaptive immune response in cells.
- The serum IgG levels of the immunized mice indicate that the vaccine can produce antigen specific antibodies.



References

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- He, Y., Zhou, Y., Siddiqui, P., Jiang, S., (2004) Inactivated SARS-CoV vaccine elicits high titers of spike protein-specific antibodies that block receptor binding and virus entry, Biochemical and Biophysical Research Communications, 325(445-452), 0006-291X