Superparamagnetic Nanoparticle Delivery of Drugs and Vaccines

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by **Informed Choice Washington (ICWA)**
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We provide these studies without comment at this time on their applicability to current phenomenon being reported following receipt of certain medical interventions.

- **Superparamagnetic nanoparticles for effective delivery of malaria DNA vaccine.**Al-Deen FN, Ho J, Selomulya C, Ma C, Coppel R.Langmuir. 2011 Apr 5;27(7):3703-12. doi: 10.1021/la104479c. Epub 2011 Mar 1.PMID: 21361304

ABSTRACT: Low efficiency is often observed in the delivery of DNA vaccines. The use of superparamagnetic nanoparticles (SPIONs) to deliver genes via magnetofection could improve transfection efficiency and target the vector to its desired locality. Here, magnetofection was used to enhance the delivery of a malaria DNA vaccine encoding Plasmodium yoelii merozoite surface protein MSP1(19) (VR1020-PyMSP1(19)) that plays a critical role in Plasmodium immunity. The plasmid DNA (pDNA) containing membrane associated 19-kDa carboxyl-terminal fragment of merozoite surface protein 1 (PyMSP1(19)) was conjugated with superparamagnetic nanoparticles coated with polyethyleneimine (PEI) polymer, with different molar ratio of PEI nitrogen to DNA phosphate. We reported the effects of SPIONs-PEI complexation pH values on the properties of the resulting particles, including their

ability to condense DNA and the gene expression in vitro. By initially lowering the pH value of SPIONs-PEI complexes to 2.0, the size of the complexes decreased since PEI contained a large number of amino groups that became increasingly protonated under acidic condition, with the electrostatic repulsion inducing less aggregation. Further reaggregation was prevented when the pHs of the complexes were increased to 4.0 and 7.0, respectively, before DNA addition. SPIONs/PEI complexes at pH 4.0 showed better binding capability with PyMSP1(19) gene-containing pDNA than those at neutral pH, despite the negligible differences in the size and surface charge of the complexes. This study indicated that the ability to protect DNA molecules due to the structure of the polymer at acidic pH could help improve the transfection efficiency. The transfection efficiency of magnetic nanoparticle as carrier for malaria DNA vaccine in vitro into eukaryotic cells, as indicated via PyMSP1(19) expression, was significantly enhanced under the application of external magnetic field, while the cytotoxicity was comparable to the benchmark nonviral reagent (Lipofectamine 2000).

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