Think you know Cyclodextrins?

Five surprising applications for this versatile class of molecule in vaccine development

For vaccine developers, there is intense interest in the critical role of functional excipients in ensuring the ultimate success of their programs and the delivery of safe, efficacious products – with cyclodextrins now being of particular note.

Hydroxypropyl-β-cyclodextrin (HPβCD) is proving to be extremely versatile beyond small molecule applications – **but what are some of the rapidly establishing applications for HPβCD in the vaccine field?**

"Liquid formulations may make processing and delivery easier, but generating liquid adenovirus formulations with acceptable long-term stability is an ongoing challenge"

"The body of work that exists provides confidence in extrapolating towards HPβCD's potential use as a stabilizer in recombinant subunit vaccines [3]"

"Adjuvants are the only proven tool available to boost vaccine immunogenicity, but the range of adjuvants commonly used across the pharmaceutical industry is limited"

01 Stabilizing Adenoviruses for Delivery

HPβCD is one of the well-established globally approved excipients that is generating increased interest for stabilizing adenovirus formulations. Being already approved for parenteral use with a good human safety profile, HPβCD has been shown to improve the long-term storage stability of vector formulations, specifically adenovirus for vaccine development [1].

02 Boosting Immunogenicity of Subunit Vaccines

Vaccines based on non-living antigens, especially subunit vaccines, tend to be poorly immunogenic meaning additional adjuvant components are needed. When used as an adjuvant, HPβCD enhances antigen (vaccine)-specific antibody titers and maintains a longer immune response compared to many adjuvants commonly used in vaccine production [2].

03 Cell Culture for Vaccine Production

Vaccine production relies on the output from strictly controlled mammalian cell cultures – with certain lipids being amongst the most essential nutrients. The use of animal-derived products is being replaced in order to avoid the associated contamination risks, and the limited solubility of lipids creates difficulties in adding them in the quantities required. HPβCD is widely used to solubilize lipids in various applications, with a significant advantage being its beneficial toxicity profile, which means it is unlikely to have any detrimental effects on cell viability.

04 mRNA Vaccines

Delivery of mRNA vaccines requires encapsulation of the molecule in systems such as lipid nanoparticles. As HPβCD interacts with lipids both in the cell membrane and in nanoparticles, it could have useful applications at different stages (potentially within the delivery technology itself to enhance cellular penetration, or as a stabilizer in mRNA vaccines).

05 Stabilizing Vaccines for Delivery

HPβCD's regulatory status as an excipient that is already approved for parenteral use makes it an attractive option as a potential stabilizing agent, with its known chemistry and its use in other pharmaceutical applications meaning it is well-characterized and available for use with no further regulatory approval required.

HPβCD holds untold, untapped potential in the field of vaccine development – as an approved and well-characterized excipient for biopharmaceutical applications. Some of these applications are still yet to be fully realized, with the Roquette team on the forefront of developing our understanding of, for example, **HPβCD's** role in stabilizing adenoviruses for delivery.

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If you would like to find out more about how cyclodextrins could form part of your program, then you can get in touch with an expert by following this link:

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1. Adenoviral vectors https://www.labome.com/method/Adenoviral-Vectors.html
2. Hydroxypropyl-β-cyclodextrin Spikes Local Inflammation That Induces Th2 Cell and Follicular Helper Cell Responses to the Coadministered Antigen https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4470223/
3. Inhibition of agitation-induced aggregation of an IgG-Antibody by hydroxypropyl-β-Cyclodextrin https://pubmed.ncbi.nlm.nih.gov/19774651/