

# Gamma irradiated vaccines: concepts and applications

Monday, 2 December 2019 16:15 (15)

Gamma irradiation has widely been used to inactivate highly dangerous pathogens such as the Ebola virus and anthrax spores from *Bacillus anthracis*. It has also been used as an inactivation method to create whole “killed” bacterial or viral vaccines that induce broader spectrum immunity compared to vaccines inactivated by either chemical or other physical means. We have previously reported the cross-protective immunity induced by gamma-irradiated influenza vaccine ( $\gamma$ -FLU) and pneumococcal vaccine ( $\gamma$ -PN) (1-3). Importantly, in 2015 the US Department of Defense reported inadequate inactivation of anthrax spores following exposure to  $\gamma$ -irradiation. This created the need for a much better understanding of the conditions and parameters required to achieve sterility of infectious materials for vaccine purposes. Supported by the Australian Institute of Nuclear Science and Engineering (AINSE), we investigated different factors affecting the sterility of  $\gamma$ -irradiated preparations. We generated inactivation curves for multiple pathogens (including Influenza A virus, Zika virus, Semliki Forest virus, and rotavirus) and our data illustrated variations in inactivation curves directly related to the nature of genetic materials and irradiation conditions. These variations in killing curves reveal an important gap in current mathematical formulae to determine sterilising doses for different pathogens. In addition, we investigated the structural integrity and immunogenicity of different vaccine preparations. This study is expected to enable further development of sterile highly effective gamma irradiated vaccines.

1. David SC, Norton T, Tyllis T, Wilson JJ, Singleton EV, Laan Z, Davies J, Hirst TR, Comerford I, McColl SR, Paton JC, Alsharifi M. Direct interaction of whole-inactivated influenza A and pneumococcal vaccines enhances influenza-specific immunity. *Nature Microbiology*. 2019 Aug;4(8):1316-1327
2. Babb R, Chen A, Hirst TR, Kara EE, McColl SR, Ogunniyi AD, Paton JC, Alsharifi M. Intranasal vaccination with  $\gamma$ -irradiated *Streptococcus pneumoniae* whole-cell vaccine provides serotype-independent protection mediated by B-cells and innate IL-17 responses. *Clinical Science (Lond)*. 2016;130(9):697-710.
3. Alsharifi M, Furuya Y, Bowden TR, Lobigs M, Koskinen A, Regner M, Trinidad L, Boyle BB, Müllbacher A. Intranasal flu vaccine protective against seasonal and H5N1 avian influenza infections. *PLoS ONE*. 2009; 4(4):e5336.

## Speakers Gender

Male

## Travel Funding

No

## Level of Expertise

Expert

## Do you wish to take part in the poster slam

No

**Primary author(s) :** ALSHARIFI, Mohammed (The University of Adelaide)

**Co-author(s) :** Ms SINGLETON, Eve V (The University of Adelaide); Dr DAVIES, Justin B. (Australian Nuclear Science and Technology Organisation)

**Presenter(s) :** ALSHARIFI, Mohammed (The University of Adelaide)

**Session Classification :** Session 9

**Track Classification :** Food, pharmaceuticals and radiotherapy