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Understanding characteristics of vaccine components using spectral decomposition

Vaccines for diphtheria, tetanus, and pertussis (DTaP vaccines) are a fundamental part of the standard vaccination schedules for both children and adults. DTaP vaccines are complex liquid formulations that result in strong spectral signals from enhancing substances (adjuvants) like aluminum salts and excipients such as phenoxyethanol. These signals need to be differentiated from the often weaker signal of the medically relevant compounds [1–4], i.e. proteins contained to elicit an immune response. In this study, we conducted comprehensive Raman spectroscopic measurements on two complete DTaP vaccines and their respective components to identify their spectral contributions. In particular, we have focused on the tetanus component of the vaccine and analyzed spectra of non-adsorbed tetanus toxoids obtained from the National Institute for Biological Standards and Control (NIBSC), UK, as a standard reference. However, this non adsorbed tetanus toxoid is formulated in a matrix of glycine, which exhibits a strong Raman signal. Consequently, we employed a series of experimental and analytical signal extraction techniques to unveil pure tetanus toxoid spectra. Eventually, we can show differential spectra of the pure adjuvant and tetanus toxoids adsorbed to the adjuvant. Our study underscores the remarkable potential of Raman spectroscopy in the identification of medically relevant DTaP vaccine components like adjuvants and tetanus toxoid, opening avenues for advanced vaccine quality control and batch testing.

References

[1] Kamp C, Becker B, Matheis W, Öppling V, Bekeredijan-Ding I, Biological Chemistry, 402(8) (2021) 1001-1006
[2] Parachalil DR, McIntyre J, Byrne HJ, Analytical and bioanalytical chemistry, 412(9) (2020) 1993–2007
[3] Zhao Y, Ji N, Yin L, Wang J, AAPS PharmSciTech 16(4) (2015) 914–921
[4] Bonnier F, Blasco H, Wasselet C, Brachet G, Respaud R et al., The Analyst 142(8) (2017) 1285–1298

Figures

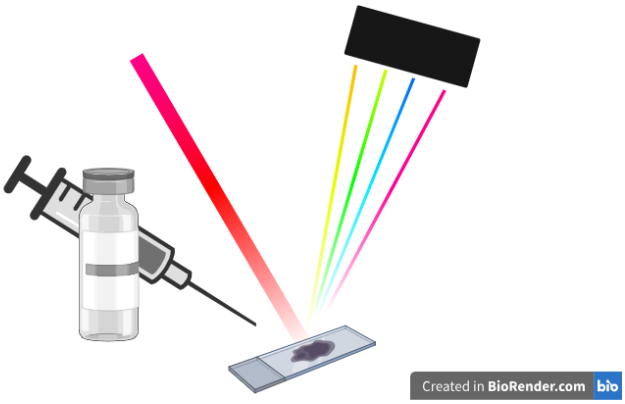

Figure 1: Analyzing vaccines with Raman spectroscopy