

Difference Between Freund's Complete and Incomplete Adjuvant

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Key Difference - Freund's Complete vs Incomplete Adjuvant

Immunology is a vast area of study. It mainly involves in antigen-antibody reactions. These type of immunological reactions are used to identify a disease or the presence of foreign bodies such as infectious agents. Antigens are markers on pathogens which are mostly proteins. Some pathogens may contain carbohydrate or lipid-based antigenic markers. Antibodies are the B cell immunoglobulins produced by the host in response to an antigen. Adjuvants are synthetic agents which are referred to as immunological agents which have the ability to enhance the immune response against an antigen or a group of antigens. Thus, the main application of adjuvants is in vaccine production, where an adjuvant is introduced to enhance the immune response of the host. It is also used in the manufacture of synthetic antibodies. There are varied types of adjuvants, out of which Freud's Complete and Freund's Incomplete Adjuvant were one of the first to be developed. **Freund's Complete Adjuvant is composed of an emulsion of water and mineral oil containing killed Mycobacteria, in contrast, Freund's Incomplete Adjuvant is composed of the emulsion of water and mineral oil without the added Mycobacteria.** Absence and the presence of the Mycobacterial component is the **key difference** between the Freud's complete and incomplete adjuvants.

What is Freund's Complete Adjuvant?

In 1936, Jules T Freund discovered the first adjuvant known as the Freund's Complete Adjuvant. Freund's Complete Adjuvant consists of heat-killed Mycobacterium tuberculosis in an emulsion of water and nonmetabolizable oils. These nonmetabolizable oils are paraffin oil and mannide monooleate. The heat killed Mycobacteria containing some antigenic property, is not responsible for causing the disease. Hence, it is involved in attracting macrophages and other cells to the injection site. This action of heat-killed Mycobacteria will enhance the immune response. Thus Freund's Complete Adjuvant is mostly administered for initial injections via a vaccine course. It is also suggested that the Freund's Complete Adjuvant also assist in the T cell activation rather than the B cell activation in providing immunity.



An essential component of Freund's Complete Adjuvant-mediated response is an intense [inflammatory reaction](#) at the site of antigen deposition. Freund's Complete Adjuvant mixtures are used in the initial immunization programs because there is a potential disadvantage of using the complete antigen, as it could develop pathogenic properties in an immune compromised individual due to long-term exposure of the adjuvant.

What is Freund's Incomplete Adjuvant?

Freund's Incomplete Adjuvants also contain an emulsion of water and nonmetabolizable oils and do not contain any heat-killed Mycobacterium species. Freund's Incomplete Adjuvants are used to produce water-in-oil emulsions of antigens. Freund's Incomplete Adjuvants induce a predominantly T helper type 2 (*Th2*) biased response through the formation of a depot at the injection site with the stimulation of antibody-producing plasma cells. This allows the slow release of the antigen and stimulates the T cells to be secreted by the plasma cells. Freund's Incomplete Adjuvants stimulate the *Th2* cells. Freund's Incomplete Adjuvants are less toxic as it does not contain any form of an organism thus it is used in the latent phase of an immunization program. The disadvantage of using Freund's Incomplete Adjuvants is the difficulty in mixing with the antigen in comparison with the Freund's Complete Adjuvants.

What are the Similarities Between Freund's Complete and Incomplete Adjuvant?

- Both contain an emulsion of water and mineral oil.
- Both participate in enhancing the immune response against an antigen.
- Both stimulate the production of T cells, mainly T helper cells.
- Both are used in the manufacture of vaccines in immunization.

What is the Difference Between Freund's Complete and Incomplete Adjuvant?

Freund's Complete Adjuvant vs Freund's Incomplete Adjuvant	
Freund's Complete Adjuvant is composed of an emulsion of water and mineral oil containing heat-killed Mycobacteria.	Freund's Incomplete Adjuvant is composed of the emulsion of water and mineral oil without any added Mycobacteria.
Effect	
Freund's Complete Adjuvant stimulates the production of <i>Th1</i> cells.	Freund's Incomplete Adjuvant stimulates the production of <i>Th2</i> cells.
Administering time	
Freund's Complete Adjuvant is administered at the early stage of the immunization program to obtain immediate effects.	Freund's Incomplete Adjuvant is administered at the later stage of the immunization program, usually used for subsequent boosts after initial injection with Freund's Complete Adjuvant.
Heat-killed Mycobacterium species	
Present in Freund's Complete Adjuvant	Absent in Freund's Incomplete Adjuvant.
Response	
Response is rapid in Freund's Complete Adjuvant.	Response is slow in Freund's Incomplete Adjuvant.
Disadvantage	
Freund's Complete Adjuvant may lead to the development of the disease in immune compromised persons due to long-term exposure.	Difficulty in formulation with the antigen during vaccine preparation is the disadvantage of Freund's Incomplete Adjuvant.

Summary - Freund's Complete vs Incomplete Adjuvant

Adjuvants are enhancers which are used to boost the immune response of a host. Freud's adjuvants were the first to introduce which contained oil-water emulsions. The complete and the incomplete adjuvants differed in the presence and absence of the heat killed Mycobacterium species respectively. Freund's Complete Adjuvant contains the killed mycobacterial component while Freund's Incomplete Adjuvant does not contain the mycobacterial component. A lot of research is

carried on with different adjuvants in order to assess the immune response. These research targets in developing more effective vaccinations to combat infectious diseases.

Reference:

- 1.“Biological Tools.” CFA | Complete Freund's Adjuvant for research | InvivoGen. Accessed 29 Sept. 2017. [Available here](#)
- 2.“Biological Tools.” IFA: Incomplete Freund s adjuvant Water-in-Oil. pre-Clinical grade vaccine adjuvant by InvivoGen. Accessed 29 Sept. 2017. [Available here](#)

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How to Cite this Article?

APA: Difference Between Freund’s Complete and Incomplete Adjuvant. (2017, October 3). Retrieved (date), from <http://differencebetween.com/difference-between-freunds-complete-and-vs-incomplete-adjuvant/>

MLA: " Difference Between Freund’s Complete and Incomplete Adjuvant " Difference Between.Com. 3 October 2017. Web.

Chicago: “Difference Between Freund’s Complete and Incomplete Adjuvant.” Difference Between.Com. <http://differencebetween.com/difference-between-freunds-complete-and-vs-incomplete-adjuvant/> accessed (accessed [date]).



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