

abcam

# Adjuvants

## Overview

Adjuvants are compounds/chemicals sometimes added to immunizing peptides to promote and help stimulate the immune response. They normally increase the amount and quality of the antibody produced. Adjuvants for use in vaccines only need to produce protective antibodies and good systemic memory for future protection. Adjuvants for antiserum production need to create high titer and high avidity antibodies. Various adjuvants are available and the aim is to use one that has minimal toxicity while helping to promote maximum immune response. The most frequently used adjuvants for both polyclonal and monoclonal antibody production are Freund's, Ribi, and Titermax among others. Polyclonal production

Polyclonal antibodies are made by immunizing with an antigen. Repeated immunizations of the same antigen at intervals of several weeks stimulates specific B cells to produce large amounts of the anti-antigen. The blood will contain a variety of antibodies, each to a different epitope on the antigen. The immune-sera can be used in its crude form, where high levels of specific antibodies are present, or the specific antibodies can be isolated from sera components by affinity purification.

### Freund's adjuvants

#### Freund's complete adjuvant (FCA)

FCA is a water-in-oil emulsion that localizes antigen for slow release within the immunized host for up to six months. It contains mineral oil, the surfactant mannide monooleate and heat killed mycobacterium tuberculosis, mycobacterium butyricum or their extracts (for aggregation of macrophages at the inoculation site). It stimulates both cell mediated and humoral immunity and preferentially induces antibodies against epitopes on denatured proteins. The disadvantage of this adjuvant is that it can produce some immunologically toxic effects, due to the non-metabolizable mineral oil and the mycobacterial elements can create severe granulomatous reactions. For this reason, it is mainly used on laboratory animals.

#### Freund's incomplete adjuvant (FIA)

Freund's incomplete adjuvant has the same formulation as FCA but it does not contain mycobacterium or its components. For this reason it is less effective than FCA in inducing high antibody titers but it is much less toxic.

### Ribi adjuvant system

Ribi adjuvants are oil-in-water emulsions. The antigen is mixed with metabolizable oil (squalene), which is emulsified in a saline solution containing Tween 80. Ribi also contains refined mycobacterial product that acts as immunostimulants and a gram negative bacterial product monophosphoryl lipid A. Ribi interacts with membranes of immune cells, resulting in cytokine induction that enhances antigen uptake, processing and presentation.

## **Titermax**

Titermax adjuvants are less toxic and contain no biological materials. They are based on mixtures of surfactant acting, linear, blocks or chains of non-ionic copolymers polyoxypropylene (POP) and polyoxyethylene (POE). Its properties induce chemotaxis, complement activation and antibody production. Titermax adjuvant forms a microparticulate water-in-oil emulsion with a copolymer and metabolizable squalene oil. The adjuvant active copolymer forms hydrophilic surfaces, which activate complement and immune cells, and increase expression of class II major histocompatibility molecules on macrophages.

## **Other adjuvants**

### **Specol**

Specol adjuvant is water purified mineral oil. It induces an immune response comparable to Freund's adjuvant while producing fewer toxic effects.

### **Aluminium salts**

Aluminium salt adjuvants are used with antigens:

- As aluminium-precipitated vaccines
- As aluminium-adsorbed vaccines

Al(OH) can be used to adsorb proteins in a ratio of 50-200 g protein/mg aluminium hydroxide. They are generally weaker adjuvants than emulsion adjuvants. However, they induce a mild inflammatory response. For safety reasons and for their efficacy at generating memory cells, they are the primary adjuvants utilized in human vaccinations.