Common Ingredients in FDA-Approved Vaccines

Vaccines to prevent infectious diseases are given to millions of babies, children, adolescents and adults and it is critical that they are demonstrated to be safe and effective. FDA requires that vaccines undergo a rigorous and extensive development program in the laboratory, as well as in animal studies and human clinical trials, to determine their safety and effectiveness. Highly trained FDA scientists and physicians thoroughly evaluate the information in a marketing application and make a determination whether to license (approve) a vaccine before it can be used in the United States. Prior to approval, as part of FDA's evaluation, FDA takes all of the ingredients of a vaccine into account. After FDA approves a vaccine, FDA continuously monitors its safety.

Why is aluminum in some vaccines?

Aluminum salts are incorporated into some vaccine formulations as an adjuvant. An adjuvant is a substance added to some vaccines to enhance the immune response of vaccinated individuals. The aluminum salts in some FDA-approved vaccines are aluminum hydroxide, aluminum phosphate, alum (potassium aluminum sulfate), or mixed aluminum salts. For example: aluminum salts are used in DTaP vaccines, the pneumococcal conjugate vaccine, the HPV vaccine, and hepatitis B vaccines.

Aluminum adjuvant containing vaccines have a demonstrated safety profile of over many decades of use and have only uncommonly been associated with severe local reactions. Of note, the most common source of exposure to aluminum is from eating food or drinking water.

Are other adjuvants used in FDA-approved vaccines?

Yes.

One vaccine for the prevention of H5N1 influenza, commonly referred to as avian influenza or "bird flu," contains the adjuvant AS03, an oil-in-water emulsion. The AS03 adjuvant is made up of the oily compounds, D,L-alpha-tocopherol (vitamin E) and squalene (/vaccines-blood-biologics/safety-availability-biologics/influenza-h5n1-virus-monovalent-vaccine-adjuvanted-manufactured-id-biomedical-corporation-questions#squalene), and an emulsifier, polysorbate 80, which helps ingredients mix together and keep them from separating, and water containing small amounts of salts. The vaccine is not commercially available, but included within the U.S. government's Strategic National Stockpile if public health officials determine it is needed.

Fluad, a vaccine for the prevention of seasonal influenza in individuals 65 years of age and older, contains MF59, also an oil-in-water emulsion of squalene (/vaccines-blood-biologics/safety-availability-biologics/influenza-h5n1-virus-monovalent-vaccine-adjuvanted-manufactured-id-biomedical-corporation-questions#squalene) oil.

Heplisav-B, a vaccine for the prevention of infection caused hepatitis B virus in individuals 18 years of age and older, contains CpG 1018. Cyfendus, a vaccine for post-exposure prophylaxis of disease following suspected or confirmed exposure to *Bacillus anthracis* (Anthrax) in individuals 18 through 65 years of age when administered in conjunction with recommended antibacterial drugs, contains CpG 7909. Both CpG 1018 and CpG 7909 are adjuvants based on synthetic DNA sequences. Cyfendus is included in the Strategic National Stockpile to be used for post-exposure prophylaxis with antibiotics in the event of a terrorist attack with anthrax.

Shingrix, a vaccine for the prevention of shingles in individuals 50 years of age and older, contains AS01B. Arexvy, a vaccine for the prevention of lower respiratory tract disease caused by respiratory syncytial virus (RSV) in individuals 60 years of age and older, contains AS01E. Both AS01B and AS01E are made of up MPL, a purified fat-like substance, and QS-21 which is purified from the bark of the Quillaja saponaria (soap bark) evergreen tree native to central Chile.

How does FDA evaluate adjuvants for safety and effectiveness?

When evaluating a vaccine for safety and effectiveness, FDA considers adjuvants as a component of the vaccine; they are not approved separately.

Why are antibiotics in some vaccines?

Certain antibiotics may be used in some vaccine production to help prevent bacterial contamination during manufacturing. As a result, small amounts of antibiotics may be present in some vaccines. Because some antibiotics can cause severe allergic reactions in those children allergic to them (such as hives, swelling at the back of the throat, and low blood pressure), some parents are concerned that antibiotics contained in vaccines might be harmful. However, antibiotics most likely to cause severe allergic reactions (e.g., penicillins, cephalosporins and sulfa drugs) are not used in vaccine production, and therefore are not contained in vaccines.

Examples of antibiotics used during vaccine manufacture include neomycin, polymyxin B, streptomycin and gentamicin. Some antibiotics used in vaccine production are present in the vaccine, either in very small amounts or they are undetectable. For example, antibiotics are used in some production methods for making inactivated influenza virus vaccines. They are used to reduce bacterial growth in eggs during processing steps, because eggs are not sterile products.

The antibiotics that are used are reduced to very small or undetectable amounts during subsequent purification steps. The very small amounts of antibiotics contained in vaccines have not been clearly associated with severe allergic reactions.

Why is formaldehyde in some vaccines?

Formaldehyde has a long history of safe use in the manufacture of certain viral and bacterial vaccines. It is used to inactivate viruses so that they don't cause disease (e.g., polio virus used to make polio vaccine) and to detoxify bacterial toxins, such as the toxin used to make diphtheria vaccine. Formaldehyde is diluted during the vaccine manufacturing process, but residual quantities of formaldehyde may be found in some current vaccines. The amount of formaldehyde present in some vaccines is so small compared to the concentration that occurs naturally in the body that it does not pose a safety concern.

Formaldehyde is also produced naturally in the human body as a part of normal functions of the body to produce energy and build the basic materials needed for important life processes. This includes making amino acids, which are the building blocks of proteins that the body needs.

Formaldehyde is also found in the environment and is present in different ways. It is used in building materials, as a preservative in labs and to produce many household products.

The body continuously processes formaldehyde, both from what it makes on its own and from what it has been exposed to in the environment. When the body breaks down formaldehyde, it does not distinguish between formaldehyde from vaccines and that which is naturally produced or environmental. The amount of formaldehyde in a person's body depends on their weight; babies have lower amounts than adults. Studies have shown that for a newborn of average weight of 6 - 8 pounds, the amount of formaldehyde in their body is 50-70 times higher than the upper amount that they could receive from a single dose of a vaccine or from vaccines administered over time.

Excessive exposure to formaldehyde may cause cancer, but the latest research has shown that the highest risk is from the air when formaldehyde is inhaled from breathing, and occurs more frequently in people who routinely use formaldehyde in their jobs. There is no evidence linking cancer to infrequent exposure to tiny amounts of formaldehyde via injection as occurs with vaccines.

Why are sugars, amino acids, and proteins added to some vaccines?

These substances may be added as stabilizers. They help protect the vaccine from adverse conditions such as the freeze-drying process, for those vaccines that are freeze dried. Stabilizers added to vaccines include: sugars such as sucrose and lactose, amino acids such as glycine or the

monosodium salt of glutamic acid and proteins such as human serum albumin or gelatin. Sugars, amino acids and proteins are not unique to vaccines and are encountered in everyday life in the diet and are components that are in the body naturally.

Why are there preservatives in some vaccines?

Preservatives are added to some vaccine formulations to prevent the growth of bacteria or fungi that may be introduced into the vaccine during its use, e.g., repeated puncture of a multi-dose vaccine vial with a needle.

Why is fetal calf/bovine serum in some vaccines?

In the manufacture of viral vaccines, the virus may be grown in cells. These cells need a source of nutrition, which in some instances may be provided by fetal bovine serum.