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DEVELOPMENT OF ADJUVANT COMPOSITIONS FOR THE CREATION OF VACCINE PREPARATIONS

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ABSTRACT

In the course of this study, the expediency of using oil adjuvants as part of an antiviral vaccine was established. The choice of excipients is justified. It was found that as auxiliary substances, the most optimal are TEA, lecithin, oleic acid, mannitol. Stable compositions were obtained using TOTAL oils and base oil. A technology for producing oil adjuvant compositions has been developed. The stability of vaccine preparations with the use of oil adjuvant compositions has been studied. The oil adjuvant is convenient in the production process, as it forms a fairly stable emulsion, the vaccine is freely injected. It was found that the most advantageous physical and technological properties for practical use were the vaccine samples with a volume ratio of antigen and adjuvant 40:60.

Keywords: adjuvant, vaccine, oil, emulsifier, stability

INTRODUCTION

Avian influenza viruses can infect humans, causing zooanthroponotic infections. Direct contact with infected animals or the environment contaminated with the biological fluids of infected birds is associated with the risk of human infection and can lead to illness (from mild flu-like symptoms to severe acute respiratory illness) or even death of a person [7].

Nowadays, the problem of zooanthroponoses is solved quite simply, there are specially developed vaccines for this, the use of which is a preventive measure and reliable protection for animals and humans [12].

In the fight against various infectious diseases, along with the development of effective vaccines that can cause persistent immunity, it is urgent to further improve existing and develop new substances that can enhance the effect of immunization [4,5].

The use of adjuvants that have an immunostimulating effect is due to the weak immunogenicity of some vaccine preparations [1,2,11]. Nonspecific stimulants are widely used to increase the immunogenicity of antigens, which lose a significant degree of initial immunogenicity during purification [10,13,15].

Currently, dozens of substances of organic and inorganic nature are known that can have an adjuvant effect [8]. Mineral compounds (aluminum oxide hydrate and phosphate gels), polymer substances,

complex chemical mixtures (lipopolysaccharides, protein-lipopolysaccharide complexes, etc.); bacteria and bacterial components; lipids and emulsifiers (lanolin, arlacel); substances that cause an inflammatory reaction (saponin, turpentine) and others are used as adjuvants [1, 3, 14].

PURPOSE OF STUDY

Development of non-specific adjuvant stimulants used in industrial immunology.

MATERIALS AND METHODS,

Modern laboratory methods, including biotechnological, technological, and virological, were used to carry out the research.

The mineral oils "Total", "Marcol", base oil Janos VHVI-4, base oil SN-80 were used in the work. The oil adjuvant "Montanid" was used as a comparison. Nonionic emulsifiers were used as emulsifying agents: twin-20, twin-60, twin-80, oleic acid, soy lecithin, triethanolamine, manit, PEG, lanolin, charge, aerosil, etc.

RESULTS AND DISCUSSION

Increasing the effectiveness of vaccines is often achieved through the use of non-specific stimulants. Despite the existing achievements, the development of promising adjuvants continues. To date, in medical and veterinary practice, most vaccines contain aluminum oxide hydrate [9]. Its effectiveness for the adsorption of anatoxin, for example, clostridium anatoxin, has been proven. Oil adjuvants (emulsions) came into practice later than others. They are an antigen dissolved or suspended in water, which is dispersed in oil. As a result, the water droplets with the antigen are in the oil phase. This type of emulsion is called "water in oil". Highly purified liquid paraffin is used as an oil. In addition to the oil, an emulsifier must be present to stabilize the mixture. The positive effect of vaccination is achieved by the fact that the mineral oil is not metabolized, so that the drops of the emulsion with the antigen inside them are retained at the injection site for a long time. After the decomposition of the emulsion as a result of enzymatic cleavage of the emulsifier, the antigen is slowly released from these droplets. Oil adjuvants cause the development of a strong inflammatory reaction, which triggers the entire mechanism of the immune response.

Nanoparticles are one of the most modern adjuvants [4]. The nanoparticles associated with the antigen are purposefully absorbed by macrophages, which leads to an increased immune response [8, 14].

In our work, we decided not to deviate from the classical scheme of manufacturing an adjuvant. The components of the emulsion were selected based on the physico-chemical properties of the substances. The following compositions of complex oil adjuvants were obtained, presented in Table No. 1.

Table No. 1. Composition of adjuvant formulations

Components of the vaccine	Composition No.											
	1	2	3	4	5	6	7	8	9	10	11	12 control
Lecithin	+				+	+	+					
Oleic acid	+			+	+					+		
TEA		+	+	+	+	+				+		
Twin-80		+						+	+			
Twin-20		+										
Aerosil								+	+			
PEG						+					+	
Lanolin							+					

Mannitol										+		
Bidistillate											+	
Charge								+				
Montanite												+
Oil	+	+	+	+	+	+	+	+	+	+	+	+
The viral part	+	+	+	+	+	+	+	+	+	+	+	+

As a result of the conducted research, the results of the prototypes were obtained. Studies on the development of a vaccine are presented in Table No. 2.

Table No. 2. – Design of research on the development of technology for obtaining adjuvant compositions for the creation of an antiviral vaccine

Research stage	The studied indicator
1. Evaluation of the quality of raw materials	Pyrogenicity, sterility
2. Selection of oil and auxiliary substances to create an adjuvant composition	Solubility, emulsifying ability, stability
3. Working out of homogenization modes	Formation of a stable emulsion
4. Characteristics of the received antiviral vaccine	Stability during storage.

CONCLUSION

Based on the obtained results of technological research, the composition and technology of adjuvant compositions have been developed. The choice of excipients is justified. It was found that as auxiliary substances, the most optimal are TEA, lecithin, oleic acid, mannitol. Stable compositions were obtained using Total oils and base oil. The optimal conditions for the homogenization of the vaccine is a speed of 2800-3000 rpm, with a given time interval of 30-40 minutes. The stability of vaccine preparations with the use of oil adjuvant compositions has been studied. It was found that the most advantageous physical and technological properties for practical use were the vaccine samples with a volume ratio of antigen and adjuvant 40:60.

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