



ORAL VACCINE CONTAINING *BACILLUS SUBTILIS* ENDOSPORES AND ITS APPLICABILITY

Product description

Recent years have seen a rapid growth of interest in *Helicobacter pylori* as a Gram-negative rod the presence of which in the stomach leads to mucositis. *H. pylori* caused infections are common throughout the world. In Poland, according to the opinion of the Polish Society of Gastroenterology, almost 70% of the population is infected. In about 80-90% of cases, as a result of infection, chronic gastritis can develop. It is reported that *H. pylori* infection is the main cause of gastric and duodenal ulcers. A significant correlation between the presence of bacteria and the occurrence of early gastric cancer was also noted.

The answer to this state of things is to develop a vaccine against *H. pylori* for patients with gastric and duodenal ulcers. The acidic environment that prevails in the stomach destroys the antibodies so that traditional immunization methods that cause a humoral response fail. The proposed vaccine contains endospores of non-pathogenic Gram-positive bacteria of the genus *Bacillus subtilis* as an antigen carrier, *Helicobacter pylori* or *Helicobacter acinonychis* urease proteins, including UreA, UreB as an antigen and antigen coat proteins, including CotB, CotG, CotZ. The use of endospores of *B. subtilis* as a carrier makes it possible to give up an adjuvant because the presence of endospores non-specifically stimulates the immune system. Because of the route of administration, immunization will occur directly in the digestive tract, the target site for the incidence of *H. pylori* infection. This form of the supply of vaccine increases its effectiveness and therapeutic efficacy

Key words

oral vaccine, *Bacillus subtilis* endospores, *Bacillus subtilis*, *Helicobacter pylori*

Legal status of the product

– Polish Patent Office:

PL 218700 "Oral vaccine containing *Bacillus subtilis* endospores and its use for immunization against *Helicobacter pylori* " Patent submitted to PPO on 29 March 2012 and marked No. P.398658 to which PPO granted a patent by means of the decision of 17 June 2014 – entity solely entitled to the invention – Medical University of Gdańsk

– European Patent Office:

European patent application submitted (2013) – entity solely entitled to the invention – Medical University of Gdańsk

The aim of the offer



ORAL VACCINE CONTAINING *BACILLUS SUBTILIS* ENDOSPORES AND ITS APPLICABILITY

The aim of the offer is the oral vaccine against *Helicobacter pylori* containing the endospores of *Bacillus subtilis*.

Foregoing funding of studies on the product

The project funded by the National Science Centre, grant No. N N401 279439.

Analysis of competition on the market

The standard form of treatment for people infected with *H. pylori* involves application of a complex drug based on two antibiotics and a proton pump inhibitor. Unfortunately, such therapy is only effective in less than 20% of patients.

According to available sources of the National Institute of Health, 104 clinical trials have been reported in the USA with *Helicobacter* as their subject. Nevertheless, the vast majority of research concerns treating the infection with two, three, and more antibiotics. Furthermore, none of the reported clinical trials indicates running a test to register the vaccine against *H. pylori*. To date, intensive work on vaccine development has been led by the researchers from several centres, i.e. Southern Medical University in Guandong and Rhode Island Hospital and the University of Rhode Island with the support of a pharmaceutical company. Each of the developed vaccine proposals has a different form of administration, composition and is at a different stage of determining therapeutic and clinical efficacy.

The proposed solution has a high potential for therapeutic use as a drug in people who are already infected. It will also greatly reduce the number of new cases of gastric cancer. The favourable form of vaccine application, even among children and the elderly, resistance to low pH in the stomach and the effectiveness of action will make the vaccine an interesting solution on the modern pharmacological market

Advantages of the product

The use of endospores as vaccine carriers represents a new approach to immunization. In this case, the oral delivery of the vaccine enables obtaining mucosal and systemic resistance and increases the half-life of the applied antigen. A definite advantage of *B. subtilis* endospores as a vaccine carrier is that they act as an adjuvant, which is evident as an enhancement of the cell-type immunological response.

B. subtilis is a bacterium with low trophic requirements that is associated with relatively low cost of endospores production in industrial quantities. Moreover, the production of endospores is a natural process and does not require human intervention in the physiology of bacteria. The finished vaccine



ORAL VACCINE CONTAINING *BACILLUS SUBTILIS* ENDOSPORES AND ITS APPLICABILITY

preparation will not have to be stored under strictly defined conditions, such as low temperatures, which facilitates transport and long-term storage. The ability to mix endospores presenting different antigens makes it possible to produce multiple combinations of quantitative and qualitative vaccines. This enables immediate preparation of the desired combination of antigenic epitopes by mixing in appropriate proportions of the recombinant endospores under standard dispensary conditions.

Administration of the endospore vaccine can have additional positive health effects, because endospores of *B. subtilis* are used as probiotics and their modification to antigen presentation will not reduce their beneficial effects on the digestive tract.

The developed formulation will be taken orally without the need for performing procedures such as injections. This solution benefits both the patient and the health-care system. The possibility of abandoning the use of disposable equipment will reduce the cost of immunizing large groups of patients.

The oral form of the vaccine will also reduce the fear of injections which causes vaccination to be delayed indefinitely in case of some patients. The patient may purchase the vaccine, for example, in the form of powder or suspension and be free to use it at any time. It gives the possibility of vaccinating large populations and eliminating or significantly reducing the incidence of *H. pylori* infection.