

Gel-Pac[®]

Gel-Pac[™] Improves the titer of Live Infectious Bonchitis (IB) vaccine for Poultry Hatcheries

Live IB vaccines were originally developed and delivered by nose drop to poultry because, logically, the respiratory tract was the tissue we were trying to protect by a mucosal response. However, eventually the economic pressure from high labor costs in developed poultry markets forced researchers to seek more cost-effective ways to deliver live virus vaccine and protect poultry. During the 1950's the IB vaccine strains were confirmed as being viscerally active, meaning they are able to provide immunity and protect the respiratory tract from disease challenges even if they are swallowed, not inhaled. From that point IB vaccines have been mass applied via both hatchery aerosol spray and drinking water. Dosing by spray at day-of hatch is still favored over dosing by drinking water after placement because, among other things, earlier application provides earlier onset of immunity.

Beyond the time and labor savings, reducing the number of times a hatchery sprays chicks is desirable because each successive pass through a vaccine mist wets the birds and induces thermal shock. Three different vaccines are commonly sprayed in the hatchery; they are vaccines against coccidiosis, Newcastle disease, and IB. When possible, hatcheries prefer to combine multiple vaccines in a single spray to reduce the number of passes and the amount of water that soaks the birds. Another way to avoid soaking the chicks is to apply the vaccine in a firm gel spray. Gel spray droplets rest on top of the feathers instead of soaking to the skin. Chicks naturally preen the large gel drops and thereby pick up the vaccine in concentrated form, where it can directly generate immunity.

Gel-Pac is a premiere edible gel delivery vehicle. Added as a dry powder to hatchery tap water, Gel-Pac suspends active ingredients like probiotics, vaccines and nutrients uniformly for even distribution on the chicks. It is also stabilized with vaccine preservatives that extend the life of viral or bacterial live vaccines, making them more uniformly effective at protecting the entire flock with higher titers.

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IB titer Research

To measure Gel-Pac's titer extension, researchers at Lasher Associates¹ compared the potency of a live IB vaccine delivered via aerosol spray in distilled water to the same vaccine delivered in edible Gel-Pac prepared with chlorinated water as a hatchery would from tap water.

Summary

A live lyophilized IB vaccine was introduced into (a) distilled water alone, a common delivery method in commercial hatcheries (b) water containing free available chlorine at 4 ppm, serving as negative control or (c) water containing free available chlorine at 4 ppm suspended in Gel-Pac Stabilizer at the label-directed concentration. Titrations of the virus were conducted in specific-pathogen-free (SPF) embryos at 0 minutes for the water-alone treatment to establish the initial titer, and again after 120 minutes for all three treatments. In the presence of chlorine, Gel-Pac fully preserved the vaccine virus against inactivation, sustaining the initial vaccine titers and preventing the decay observed in the negative control.

Method

Vaccine preparation. A live commercially available IB vaccine, MILDVAC[®]- ARK2, was reconstituted in 10 ml of water and then diluted to a concentration of approximately 1 label dose per ml in each of 3 vaccine sprays:

- Sterile distilled (DI) water
- DI water containing chlorine at 4 ppm serving as tap water
- DI water containing 4 ppm chlorine plus Gel-Pac at the label-directed concentration

The vaccine in water was titered immediately and after 120 min to quantify the amount of virus as positive controls. The vaccine in the other two preparations was titered at the end of a 120 min residence in solution. The 4 ppm concentration of chlorine was selected to represent typical concentrations found in hatchery tap water, and the 120 minute duration was deemed to exceed the normal pot life required for a hatchery gel vaccine spray.

Vaccine titers. Titrations were conducted in triplicate using specific-pathogen-free (SPF) embryonated eggs. The method was the one required for vaccine manufacturers, described in Title 9, Code of Federal Regulations §113.329. The method of Reed and Muench was used to calculate the EID₅₀ per dose.



Results. The geometric mean titers of the IB vaccine in water alone at initial time zero and at 120 min were $10^{3.8}$ and $10^{3.6}$ EID₅₀/ml, respectively. In chlorinated water (no stabilizer) the final 120 minute titer reduced to $10^{2.6}$ EID₅₀/ml. In contrast, the titer of the virus exposed to water containing 4 ppm chlorine and extended with Gel-Pac remained $10^{3.8}$ EID₅₀/ml at 120 minutes. The final titer of the Gel-Pac stabilized chlorine solution contained over 10 times more live vaccine virus than the non-stabilized solution, equal to the initial titer (see figure).

Impact

IB vaccine protects poultry against bronchitis infection when either inhaled as an aerosol or when ingested via oral-gastric exposure. Consequently poultry producers frequently administer IB vaccine via the oral route to birds after leaving the hatchery. Gel-Pac is a powdered vaccine stabilizer designed to create a protective suspending gel when mixed with hatchery tap water. The edible gel facilitates oral vaccination while hatchling poultry are still in the hatchery by allowing them to consume the gel droplets rather than inhale atomized spray. One potential advantage includes the ability to combine the vaccine with other oral actives in a single gel spray. Successful application requires the gel itself to be inherently safe for the vaccine and for the gel to preserve the vaccine in the presence of potential oxidizers in the tap water used to prepare the gel or in other additives the vaccine may be mixed with.

This research sought to determine if Gel-Pac protects the vaccine from toxic oxidizers which may exist in the hatchery tap water or well water. As expected, after 120 minutes the vaccine was significantly degraded in chlorinated water, dropping to $10^{2.6}$ EID₅₀/ml (94% loss from the input control). Gel-Pac did protect the vaccine against this oxidation, preserving the initial concentration $10^{3.8}$ EID₅₀/ml at 120 minutes (15-fold higher vaccine titer than the same solution without Gel-Pac).

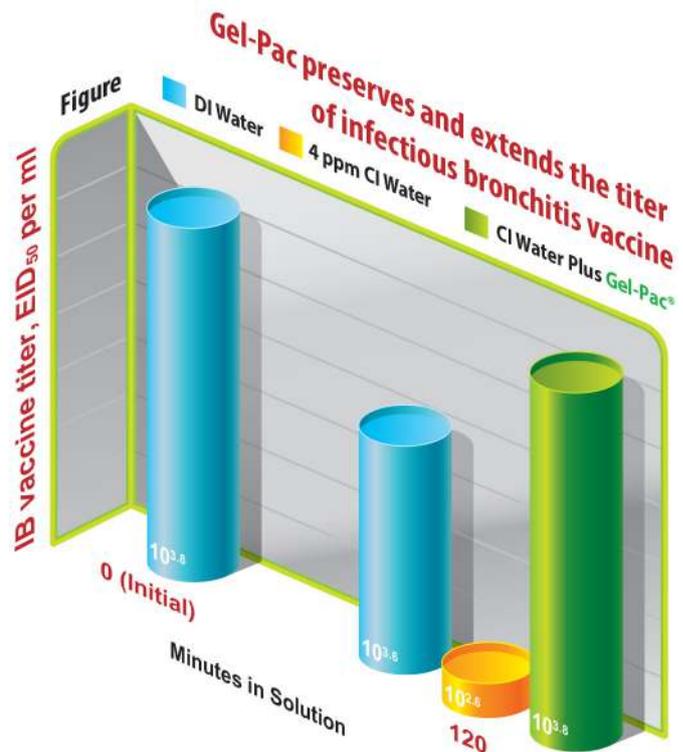


Figure. Gel-Pac preserves and extends the titer of infectious bronchitis vaccine



Gel-Pac proved both safe to the vaccine and effective at preserving the vaccine against potency declines in water that otherwise would be lethal to it. Gel-Pac has been used commercially to stabilize and accelerate the administration of oral additives such as probiotics in an edible gel given at day of hatch. This research confirms similar previous findings with Newcastle disease vaccine in which Gel-Pac also protected vaccine from inactivation by lethal oxidizers in the hatchery water supply.

IB vaccines are fragile. Consequently, they have not been recommended in combination with other sprayed additives that may pose a risk of inactivating the vaccine and rendering it useless. In addition to Gel-Pac delivering the vaccine alone, its preserving protection may allow IB vaccine to be combined with other oral additives, streamlined into a single gel spray. Edible gel is intuitively more appropriate as a vehicle for many additives. Testing Gel-Pac's potential to permit vaccines to be administered with a wider array of edible additives remains a further focus of study.

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²Mildvac is a registered trademark of Merck Animal Health, Madison, New Jersey, USA. Mildvac-Ark is a 3168 strain of Arkansas-type IB, low reactivity and high immunogenicity lyophilized vaccine for prevention of the Arkansas-type of infectious bronchitis (IB). It is approved for spray vaccination of chickens 1 day of age or older.