

UNIVERSIDAD DE LA FRONTERA

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales



**DEVELOPMENT OF AN ORAL DELIVERY SYSTEM FOR
IMMUNOSTIMULANTS AGAINST PISCIRICKETTSIA
SALMONIS INFECTIONS**

**DOCTORAL THESIS IN FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE
DOCTOR OF SCIENCES IN NATURAL
RESOURCES**

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**“Development of an oral delivery system for immunostimulants against
Piscirickettsia salmonis infections”**

Esta tesis fue realizada bajo la supervisión del director de tesis, Dra. Mónica Rubilar del Instituto de Agroindustria de la Universidad de la Frontera y ha sido aprobada por los miembros de la comisión examinadora.

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Thesis summary

In this Thesis, we evaluated the effect of alginate-encapsulated *Piscirickettsia salmonis* antigens (AEPs) incorporated in the feed as an oral vaccine to induce the immune response in Atlantic salmon (*Salmo salar*). AEPs were produced by ionic gelation using an aerodynamically assisted jetting (AAJ) system and characterized using a microscope. The Taguchi method was used to optimize antigen encapsulation efficiency (EE%). The effect of environmental and gastrointestinal conditions on microparticle stability were evaluated. Fish were distributed into three vaccination groups (injectable, oral high dose, oral low dose). The *P. salmonis*-specific IgM levels in blood plasma were measured by ELISA. The AAJ system was effective in preparing small microparticle size with an EE% of 97.92%. Environmental conditions (pH, salinity and temperature) generated instability in the microparticles triggering protein release. Incorporation of AEPs did not affect the palatability of the feed or the fish appetite. Furthermore, the oral vaccine did not have a negative effect on fish growth. Finally, the oral vaccine (high and low dose) produced an acquired immune response (IgM) similar to the injectable vaccine. These findings suggest that AEPs incorporated in the feed can be an effective alternative to boost the immune response in Atlantic salmon (*S. salar*).

