

UNIVERSIDAD DE LA FRONTERA

Facultad de Ingeniería y Ciencias

Doctorado en Ciencias de Recursos Naturales



**STUDY OF THE SYNTHESIS HYPOTHETICAL MECHANISM
FOR THE FORMATION OF
SILVER NANOPARTICLES (AgNPs) WITH ANTIMICROBIAL
ACTIVITY**

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

CARLA ORIETTA CISTERNAS NOVOA

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“Study of the synthesis hypothetical mechanism for the formation of silver nanoparticles (AgNPs) with antimicrobial activity”

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

.....
Dr. Francisco Matus Baeza
DIRECTOR DEL PROGRAMA DE
DOCTORADO EN CIENCIAS DE
RECURSOS NATURALES

.....
Dra. Olga Rubilar

.....
Dr. Víctor Beltrán Varas
DIRECTOR ACADEMICO DE
POSTGRADO
UNIVERSIDAD DE LA FRONTERA

.....
Dr. Cledir
Santos

.....
Dr. Nelson Lima

.....
Dra. Gladys Vidal

.....
Dra. María Cristina Diez

.....
Dr. Gonzalo Tortella

Thesis summary

This project aims to replicate the silver nanoparticle (AgNP) synthesis mechanism utilized by fungi in vitro, utilizing redox biomolecules such as L-cysteine to produce AgNPs with suitable physicochemical properties for use as antimicrobial agents. Key molecules involved, including Flavin adenine dinucleotide (FAD), hydroquinone (HQ), and L-cysteine (L-cys), were identified, with FAD acting as a coating and HQ as a stabilizer. This approach successfully generated AgNPs and elucidated the underlying mechanism using only these molecules. Surprisingly, these AgNPs demonstrated antibacterial activity against *Escherichia coli*, *Staphylococcus aureus*, *Serratia marcescens*, and *Salmonella sp.*, highlighting their potential as versatile antimicrobials within the biomedical industry. This study presents an accessible, environmentally-friendly, and cost-effective route for synthesizing AgNPs with robust antimicrobial properties.