NEW FORMULATION FOR BIOLOGICAL CONTROL OF PESTS AND/OR DISEASES IN AGRICULTURAL CROPS

PATENTED TECHNOLOGY

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ABSTRACT

The Phytopathology research group of the University of Alicante has developed a new simple method for the production of formulations for use in agriculture and veterinary medicine.

The key to this formulation is the method used to obtain coacervates, which involves the encapsulation of spores (conidia and/or chlamydospores) of a fungus used for biological control in agriculture in chitosan.

The formulation can be used as a biofertiliser, biostimulant and/or as an inducer of defence mechanisms in agricultural crops.

This technology is developed at laboratory level and is protected by a patent application. The research group is looking for companies with the capacity to commercially exploit the technology.

INTRODUCTION

Polymers, biopolymers, and more specifically chitosan have been used as antimicrobials primarily against bacteria and fungi applied in solution, film and other formulations. It has been shown to be effective in the control of plant pests and diseases. It also induces plant defence mechanisms against pre- and post-harvest plant diseases.

Pochonia chlamydosporia is able to reduce root colonisation by plant pathogenic fungi and the damage they cause. In turn, *Pochonia chlamydosporia* parasitises eggs of cyst-forming and gall-forming nematodes. The fungus uses appressoria and extracellular enzymes (mainly proteases, chitin deacetylases and chitosanases). It also promotes plant growth by producing growth regulators.

Encapsulation involves forming a protective layer around an active ingredient or cell. Processes using chitosan encapsulation include ionotropic gelation, precipitation, spray-drying, simple coacervation, complex coacervation, chemical cross-linking, thermal cross-linking and emulsification.

Simple coacervation is based on the decrease in solubility of the polymer, which forms a layer or particle by dripping an acidic solution of the polymer onto a basic solution. This results in the precipitation of the polymer and the formation of a capsule of the polymer. Coacervation is mainly used for the controlled release of compounds.

According to scientific literature, some fungi have the ability to remain viable encapsulated in different polymers. This is why the Phytopathology research group of the University of Alicante has designed a simple coacervation method composed of a biopolymer (chitosan) and spores of the fungus *Pochonia chlamydosporia*.

TECHNICAL DESCRIPTION

The Phytopathology research group of the University of Alicante has developed a method to obtain coacervates* in which the main component is a biopolymer (chitosan) which is used as a matrix to encapsulate spores (conidia and/or chlamydospores) of *Pochonia chlamydosporia*, a nematophagous fungus used as a biological control agent of phytopathogenic nematodes and promoter of crop development and defences.

The selected fungus, *Pochonia chlamydosporia*, is able to degrade this substrate (chitosan) and feed on it, giving it an advantage over other fungi to grow and colonise the soil and/or crop roots. It also causes the release of the compound from the coacervate to produce toxicity to other chitosan-sensitive microorganisms.

Therefore, the coacervate obtained can be applied to crops as a biological control tool against nematodes and/or insects. It can also be used in veterinary applications for the treatment of intestinal diseases in animals due to nematodes.

The method for producing the coacervate can be summarised in the following **steps**:

1. Dissolving the chitosan in a weak acid buffer solution. Addition of the Pochonia chlamydosporia fungus spores, followed by stirring until a homogeneous dispersion is obtained.
2. Addition of the homogeneous dispersion from the previous step to an aqueous solution at basic pH, obtaining solid particles of a coacervate formed by the chitosan and the spores by drip.
3. Washing of the coacervates until the pH decreases below 10.
4. Drying of the coacervates.
5. Storage of the coacervates in sterile containers.

(*) **Coacervation** means the formation of a protective coating or creation of a particle with at least one polymer and one or more cells or spores.

TECHNOLOGY ADVANTAGES AND INNOVATIVE ASPECTS

MAIN ADVANTAGES OF THE TECHNOLOGY

This technology has the following advantages:

- It makes use of chitosan as the main component, a natural biopolymer, thus avoiding the use of chemically synthesised nematicides, many of them being toxic and some even banned;
- This is a simple process, thus avoiding more complex and costly encapsulation processes;
- If the fungus colonises the root of the plants, it prevents other phytopathogenic fungi from doing so;
- Chitosan added to the soil favours the growth of the fungus *Pochonia chlamydosporia* and also causes the plant to activate its defence systems which joins the action of the biological control agent;
- Chitosan promotes crop growth at low doses;
- The addition of chitosan in the form of coacervates results in a slow release of chitosan and higher doses of concentration can be applied which would not be harmful to plants as is the case when added in liquid form.

INNOVATIVE ASPECTS

The main innovative aspect of the technology is the method used for the formation of chitosan coacervates and fungal spores and their use:

- In agriculture, as a tool for the control of pests and/or diseases in agricultural crops caused by nematodes and/or insects, and;
- In veterinary medicine, for the treatment of intestinal nematodes in animals.

CURRENT STATE OF DEVELOPMENT

The technology is developed at **laboratory scale**.

MARKET APPLICATIONS

The present invention falls within the field of **agrobiotechnology** and, in particular, refers to the production of coacervates from a polymer for practical application against pests and diseases in plants.

The coacervates produced by the method described above have application in **agriculture**, more specifically, in the control of

pests and/or diseases in agricultural crops caused by nematodes, insects and combinations of the above.

Additionally, the coacervates described above can be used as **biofertilisers, biostimulants** and/or as **inducers of defence mechanisms in agricultural crops**.

Finally, these coacervates could also be used in veterinary medicine, more specifically, for use in the treatment of intestinal nematodes in animals.

COLLABORATION SOUGHT

The research group is looking for companies interested in acquiring this technology for **commercial exploitation** through:

- Patent license agreements.
- Technical cooperation (R&D projects) to adapt the technology to the needs of the company.
- Proof of concept projects
- Etc.

Company profile searched:

- Biofertiliser manufacturers.
- Manufacturers of bio-stimulants.
- Manufacturers of anti-parasitic medicines for animals.
- Companies in the biological pest control sector.
- Companies in the agrobiotechnology sector.

INTELLECTUAL PROPERTY RIGHTS

This technology is protected by **patent application**.

- *Patent title: " Obtención de coacervados y su uso como herramientas de control biológico en agricultura ".*
- *Application number: P202231040*
- *Date of application: 01/12/2022*

MARKET APPLICATION (2)

Agri-food and Fisheries
Biology