

SEAWEED EXTRACT (ULVA AUSTRALIS) FOR THE PREVENTION AND/OR TREATMENT OF NEURODEGENERATIVE RETINAL DISEASES

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ABSTRACT

The Phytopathology research group of the University of Alicante has obtained an extract of *Ulva australis* that has antioxidant activity and cell proliferative activity.

This extract could be used as a pharmaceutical formulation for the prevention and/or treatment of neurodegenerative diseases of the retina, especially those involving oxidative stress or photoreceptor loss, such as: age-related macular degeneration, glaucoma, hereditary retinal dystrophies, diabetic retinopathy and retinitis pigmentosa.

This extract, which is protected by a patent application, has been developed at laboratory scale. Companies interested in its commercial exploitation are sought.



INTRODUCTION

Oxidative stress is a common factor in many neurodegenerative diseases, including those affecting the retina, such as age-related macular degeneration (AMD), glaucoma, hereditary retinal dystrophies, diabetic retinopathy and retinitis pigmentosa.

The retina is particularly vulnerable to oxidative stress due to its high metabolic activity and exposure to light and oxygen. Photoreceptors, which are light-sensitive cells in the retina, consume large amounts of oxygen due to their high concentration of mitochondria. For this reason, the use of antioxidants is considered a possible strategy to treat neurodegenerative diseases of the retina. Many antioxidants have been tested in preclinical models and clinical trials for this purpose.

Although some antioxidant compounds, such as tauroursodeoxycholic acid (TUDCA) and saffron extracts, have been shown to be effective in protecting retinal cells, they are expensive and not always environmentally friendly. This is why algae have emerged as a promising source of antioxidant compounds. In fact, extracts from green, red and brown algae have shown efficacy in the prevention and treatment of neurodegenerative diseases.

In the case of the genus *Ulva*, several species have been shown to have antioxidant properties and other benefits. However, despite the fact that *Ulva australis* is abundant in the Mediterranean and in environments with high nutrient levels, no specific studies have been conducted on the antioxidant capacity of *Ulva australis* extracts in cell cultures or biological tissues. Specifically, no studies have been conducted on the antioxidant capacity of extracts of this algae on retinal cells, which are subject to much greater oxidative stress.

TECHNICAL DESCRIPTION

The Phytopathology group of the University of Alicante has obtained an **extract of the algae *U. australis*** with a **high natural antioxidant capacity**.

Thanks to this capacity, **tested on cell cultures *in vitro***, its use could **reduce the effects** of degenerative diseases that involve oxidative stress, especially in **degenerative diseases of the retina**. This effect is enhanced by its ability to promote cell proliferation in retinal cells, which favours the cell regeneration of this organ, helping to prevent, delay the progression and treat various degenerative diseases of the retina, acting on the one hand by preventing cell death of cones and rods (photoreceptors) and, on the other hand, promoting their proliferation.

Therefore, the extract could form part of a pharmaceutical formulation to **protect retinal cells from oxidative damage** and **increase cell proliferation**, an effect not described in any of the other algal extracts with antioxidant effects described in the scientific literature.

A **boiling-maceration method** was used to **obtain the extract**. This method extracts compounds with a medium yield (boiling) and thermosensitive compounds (maceration). The *U. australis* extract obtained has an intense green color and is composed of **different types of lipids, phenols and flavonoids**.

ADVANTAGES AND INNOVATIVE ASPECTS

MAIN ADVANTAGES OF THE TECHNOLOGY

The main advantages of this technology are the following:

- The extract obtained from *U. australis* is an extract with natural antioxidant capacity.
- Large quantities of the raw material used are available in the natural environment.
- The extract is obtained in an easy way and using a sustainable and environmentally friendly method.
- The extraction method employed allows for higher yields, a higher number of thermosensitive molecules, as well as higher molecular integrity than conventional methods using temperatures above 60°C.

INNOVATIVE ASPECTS

The main innovative aspect of this technology lies in the use of an algal extract of *U. australis* to protect retinal cells from oxidative damage. In addition, the extract significantly increases cell proliferation, an effect not described in other algal extracts.

CURRENT STATE OF DEVELOPMENT

The method for obtaining the extract has been developed on a laboratory scale.

The antioxidant effects of the extract and its protection against retinal degeneration of the extract were studied in the photoreceptor-derived cell line 661W.

After several laboratory-scale experiments, it is concluded that *U. australis* extract has *in vitro* antioxidant activity in cell cultures, which makes possible its use as an antioxidant in the medical field.

Furthermore, its oxidative damage-reducing effect on the 661W cell line supports its use to prevent and treat neurodegenerative diseases involving oxidative stress, especially those affecting photoreceptors (specialised neuronal cells), such as neurodegenerative diseases of the retina.

In addition, its cell proliferation-promoting action reinforces the interest of this extract for use in the prevention and treatment of retinal diseases, especially neurodegenerative diseases involving the loss of photoreceptors.

As next steps, a process to maximize metabolite yields in the extraction process should be addressed, and could even be extrapolated to other cell lines.

MARKET APPLICATIONS

The present invention is framed in the field of **biomedicine**, specifically it provides a **natural source of antioxidant compounds** that also have the capacity to enhance the **cell proliferation** of retinal photoreceptors, and therefore its use is proposed for the **treatment of neurodegenerative diseases**, especially those affecting the **retina**.

These retinal degenerative diseases include, but are not limited to, age-related macular degeneration, glaucoma, hereditary retinal dystrophies, diabetic retinopathy and retinitis pigmentosa.

Commercial exploitation of this *U. australis* extract could therefore be of interest to pharmaceutical, biotechnology and ophthalmology companies.

COLLABORATION SOUGHT

Companies interested in acquiring this technology for **commercial exploitation** are sought:

- Patent licence agreements.
- R&D projects for the joint development of technology according to the needs of the company.

Types of companies sought:

- Pharmaceutical companies, especially those focused on neurodegenerative therapies.
- Companies specialising in ophthalmology developing treatment for eye diseases and/or gene and cell therapy technology.
- Biotechnology companies developing new therapies and seeking innovations in the treatment of chronic and neurodegenerative diseases.
- Nutraceutical companies developing bioactive ingredients for health and nutrition applications.
- Cosmetic companies
- Food industry, companies producing functional foods and superfoods.
- Companies in the agriculture and aquaculture sector, especially those involved in the cultivation and exploitation of seaweed.

INTELLECTUAL PROPERTY RIGHTS

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

- *Patent title: "Ulva australis extract with antioxidant activity and cell proliferative activity".*
- *Application number: P202430643.*
- *Date of application: 29 July 2024.*

MARKET APPLICATION (5)

Agri-food and Fisheries
Biodiversity and Landscape
Marine Studies
Pharmacology, Cosmetics and Ophthalmology
Medicine and Health