

# Processes and compositions for the production of astaxanthin from marine organisms

## Abstract

The present invention relates to a method for preparing astaxanthin comprising a step of purifying astaxanthin from gonads, in particular from sea urchin eggs, and to specific food compositions for sea urchins. Such compositions have also been found to be particularly useful for increasing gonad production and/or prolonging the reproductive capacity of a sea urchin.

## State of the art

The production of astaxanthin from natural sources has become a very important activity in biotechnology, as this substance is highly sought after in food, nutraceutical and pharmaceutical applications. Commercial astaxanthin is mainly obtained from *Haematococcus pluvialis* (a microalgae) and through chemical synthesis. Chemical synthesis is undoubtedly the most cost-effective method of production but, in this case, astaxanthin is obtained from petrochemicals and is not suitable for human consumption. Astaxanthin of natural origin, although suitable for human consumption, has very high and not always sustainable production costs.

Finally, it should be noted that so far astaxanthin has been administered to animals (as well as sea urchins) to improve the appearance of their marketable products (meat, gonads, eggs, etc.).

## Invention Description

Sea urchin eggs have been found to be a valuable source of natural astaxanthin (astaxanthin therefore is not administered to, but extracted from them).

The present invention consists of a method for rearing sea urchins and defining a specific feed composition (Fig. 1) that primarily maximises astaxanthin production from the urchins. The concentration of astaxanthin determined in sea urchin samples reared according to the process of the present invention is more than 15 times higher than the concentration in wild type samples. The present result is also obtained because the method makes it possible, in addition, to increase the production of gonads and, therefore, of eggs from which astaxanthin can be extracted (Fig. 2).

The culture method makes the resource consistently available over time and sustainable (e.g. a single gamete collection varies between 4.5 and 6.9 g).

Thanks to the present invention, it is therefore possible to obtain astaxanthin of natural origin, and thus also for human consumption, in a sustainable manner.



FIGURA 1 – Specific feed composition for sea urchins



FIGURE 2 – Sea urchin egg extraction

## Industrial Property

Italian patent filed on 18/05/2017 granted with the no. 102017000053831

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## Advantages

The advantages of this patent are the following:

- the process of maintaining and feeding sea urchins according to the present invention has the double advantage of improving both the available biomass and the bioaccumulation of natural astaxanthin in the eggs;
- the rearing method according to the present invention, mainly based on the feeding of specially formulated foodstuffs, has great additional advantages, including their constant quality (without seasonal differences) and ease of preservation and storage;
- the invention promotes the production of natural astaxanthin in a sustainable manner (up to 35 mg/g) (Fig.3);
- The method is easily applicable on an industrial scale.

## Applications

This patent finds application in the following areas:

- In niche aquaculture - the application may concern the "only" production of the animals (i.e. fattening with the formulated food) or the production of the animals together with the production of the formulated food compound or, again, the only production of the patented compound to be sold to the aquaculture plants;
- In the nutraceutical and cosmeceutical fields - the application may concern the production of lyophilised sea urchin eggs (which could take place in the same sea urchin aquaculture/maintenance facility);
- In the pharmaceutical field - the application may concern the processing of sea urchin eggs (starting from fresh or from lyophilised) for the extraction and purification of astaxanthin.

## Development stage

### Current TRL: 3-4

In vivo experiments were carried out on animals bred and fed exclusively with the formulated food. The results obtained - the collection of sea urchin eggs and the related extraction of astaxanthin - were compared with animals reared but not fed with the same compound.

### Perspective TRL: 5

Pilot lots of feed composition are produced for further development in in animal model systems.

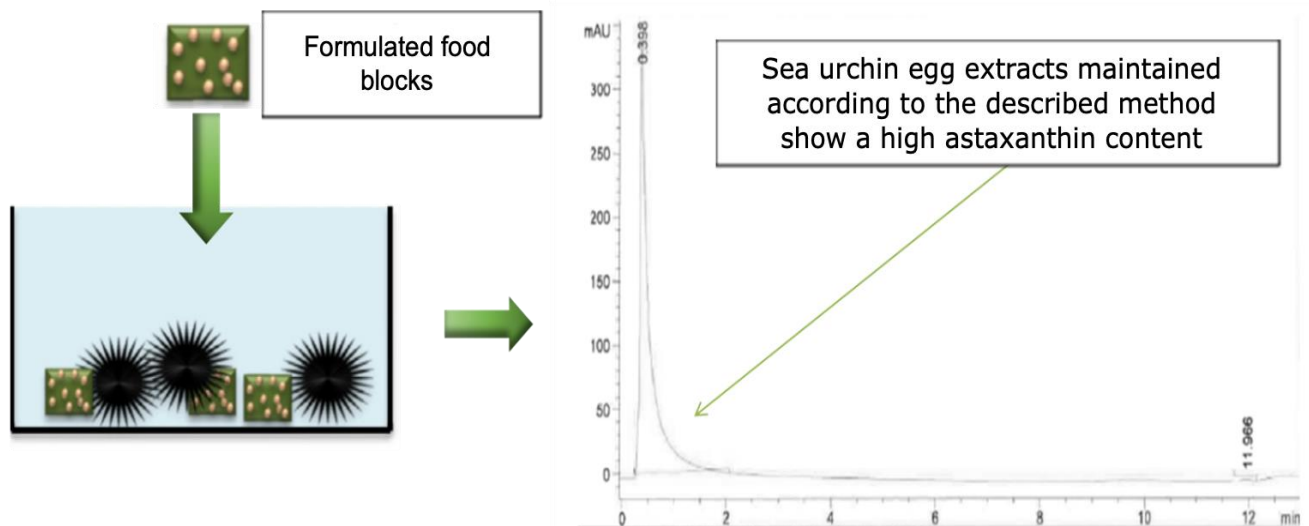


FIGURE 3 – The peak of astaxanthin production for sea urchins maintained according to the patented method