Volcanic hot springs microalgae, a promising protein source for the future

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Credit: Wageningen University

Researchers at Wageningen University in the Netherlands have successfully developed a method to produce a promising microalga species that grows in an unlikely environment: the world's volcanic hot springs.

Galdieria sulphuraria is an extremophile microalga species with blue

pigment that can live in extreme conditions and could represent a resilient source of protein for the food and feed of the future. "This is the first time the nutritional profile of this species has been accurately quantified and understood," says Pedro Moñino Fernández, Ph.D. student and lead researcher on the ProFuture project.

"We are now closer to real applications of this interesting and unexploited microalga that could have a significant impact on how the world feeds itself." The research results represent a key milestone for ProFuture, a project that scales up microalgae production as a sustainable, protein-rich food and feed ingredient.

As an extremophile species Galdieria sulphuraria can live in extreme environments that are typically not conducive to life. Although the species has been studied for decades due to its resilience and adaptability, it had not been examined as a possible food source or produced at scale yet. ProFuture studied a strain growing in the hot springs in the Naples region of Italy, and found the following results.

Nutritional profile: Great potential as an alternative protein source

G. sulphuraria biomass was found to have protein content in the range of 62-65%, which is relatively high compared to other algal and fungal microorganisms with protein contents ranging from 30-70%.

In addition, G. sulphuraria proteins have a good amino acid profile, including all essential amino acids. The proteins are especially rich in two amino acids rarely found in such high levels in non-animal-based proteins: cystine and methionine.

A better source of blue pigment

"Microalgae offer some key advantages compared to other microorganisms currently being studied as potential food sources. They are a natural source of essential fatty acids, and species such as G. sulphuraria are among the few naturally occurring sources of blue pigment," says Iago Dominguez Teles, the project manager at Wageningen University.

G. sulphuraria contains a high concentration of a natural blue pigment commonly used as a colorant in cosmetics and food. This pigment has also been found to have antioxidant properties, as well as potential as a therapeutic agent. Compared to extractions of the already commercially produced microalgae strain Spirulina, the blue pigment extracted from G. sulphuraria demonstrates greater stability, increasing its potential in industrial applications. In addition, a mixotrophic production process is able to increase concentration of the blue pigment.

A scalable production model: Mixotrophic cultivation of microalgae

The researchers developed an innovative production process using mixotrophy—combining both photosynthesis and sugar-based feedstock to stimulate the growth of microalgae. To further validate the process beyond the bench scale, they could successfully demonstrate pilot production in a 1300-liter (1.5 cubic meter) bioreactor at Wageningen University.

In order to effectively exploit the promising results of G. sulphuraria, additional research is needed to assess its digestibility and to identify any additional processing methods that may be required for commercial applications. The European Food Safety Authority (EFSA) is currently assessing the safety of Galdieria sulphuraria as a novel food for the general population and as a food supplement for adults. In addition, Blue

Galdieria extract is assessed as a food additive.

Provided by Wageningen University