ELSEVIER

Biotechnology Advances 18 (2000) 547–548

BIOTECHNOLOGY ADVANCES

Editorial

Marine biotechnology — a neglected resource

Considering their great number and diversity, marine organisms represent a vast but mostly neglected resource of novel and useful biochemicals. Marine microalgae, cyanobacteria, sponges and other species have been shown to produce cytotoxic agents with potential anticancer activity, antiviral compounds, antibiotics, insecticides, pigments and colorants, essential fatty acids, and other molecules of interest. In some cases, these compounds are produced in sufficient concentrations for commercially viable extraction from purposely cultured organisms. More often, production is not economic unless productivities can be raised quite a lot.

A case in point is that of microalgae. Of the marine microorganisms, only microalgae are grown to any scale in controlled culture. Pure cultures of algae in photobioreactors can produce large amounts of molecules such as eicosapentaenoic acid (EPA, an $\omega-3$ polyunsaturated fatty acid) and astaxanthin. There is a substantial demand for both these compounds. Moreover, the worldwide demand for EPA is set to expand because of proved usefulness of that fatty acid in treating certain ailments. Despite a strong market pull, microalgae-derived EPA remains uncompetitive with EPA obtained from fish oil (the only current commercial source). Similarly, algae-derived astaxanthin remains much more expensive than the chemically synthesized compound.

For cost-effective production, the productivity of the metabolites of interest must increase. How can this be achieved? Photobioreactor engineering is now sufficiently developed that further improvements over the best designed photobioreactors cannot produce a quantum jump in productivities of algal cultures. Improvements must now come from biology. Many laboratories working on algal genetics seem to be perpetually on the verge of breakthroughs without actually achieving anything. Often, the claims made for gene-modified or otherwise selected overproducing strains have not lived up to expectations. Either the strain was unstable, or it failed to perform in the conditions of large-scale culture systems. Similar problems affect production of sponge-derived biochemicals. In some cases, the productivities are so low that the entire wild population of a producer species can provide barely sufficient material for a single experimental treatment. Controlled culture of sponges is of course possible but the growth rates under best conditions are much too small for viable production processes. Again, the need is to select or engineer overproducers. Also, sponge cell culture needs to be examined in some detail, as whole organism culture is unlikely to be a viable foundation for a production process.

PII: S0734-9750(00)00056-2

The contribution of marine biotechnology to producing useful compounds is bound to expand in the future, but significant obstacles must be overcome. Under the present circumstances, it will be a long time before marine species can contribute extensively to industrial bioprocesses.

Y. Chisti
Department of Chemical Engineering,
University of Almería, 04071 Almería, Spain
Tel.: +34-950-01-5566; fax: +34-950-01-5484.
E-mail address: ychisti@hotmail.com