Docosahexaenoic acid production by Aurantiochytrium sp. using fermented defatted soybean as a nitrogen source for sustainable fish feed development

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Abstract

The demand for ω3-docosahexaenoic acid (DHA) for pharmaceutical, functional food, and fish feed applications has increased rapidly because of its various beneficial physiological effects. The stability and sustainability of the current DHA supply have been discussed because of its reliance on fish oil as the primary source. In this study, we focused on the production of DHA-containing microbial lipids by *Aurantiochytrium* sp., which is a promising DHA producer. In particular, we addressed the use of defatted soybean as a nitrogen source for its cultivation. Defatted soybean is a plant biomass that could provide a sustainable supply at a low cost. Results showed that *Aurantiochytrium* sp. could not directly assimilate the defatted soybean as a nitrogen source but could grow well in a medium containing defatted soybean fermented with rice malt (koji). When cultivated in a fermented defatted soybean (FDS) medium, *Aurantiochytrium* sp. showed vigorous growth with the addition of sufficient sulfate and chloride ions as inorganic nutrients without seawater salt. A novel isolated *Aurantiochytrium* sp. 6-2 produced a titer of 15.9 g of DHA per liter with total fatty acid production of 54.8 g/L in 1 L of FDS medium under optimal conditions. A feeding trial for *Scomber japonicus* was also performed, and it was revealed that 50% of fish oil DHA could be replaced with microbial DHA. Therefore, DHA produced by *Aurantiochytrium* sp. using fermented defatted soybeans could be an alternative source of natural DHA especially for fish feed derived from fish oil.

Keywords: ω3, Docosahexaenoic acid, polyunsaturated fatty acid, plant biomass, fermented defatted soybean, Aurantiochytrium sp.

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