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Potential Effects of Steviol Glycosides from *Stevia Rebaudiana* Leaf on Marine Life: A Mini Review

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Abstract

Steviol glycosides, extracted from the leaves of the *Stevia rebaudiana* plant, have gained widespread acceptance as a non-caloric sweetening alternative used in the food industry. Despite their growing popularity, the potential consequences of these sweeteners on marine ecosystems have not been thoroughly examined. This review aims to outline current knowledge and identify areas for future research.

Keywords: Steviol glycosides; Fibroblasts; Antioxidant enzymes; Bioaccumulation

Mini Review

After consumption, these sweeteners are excreted by humans and enter the sewage system. Wastewater Treatment Plants effectively remove many contaminants, while they often do not completely remove artificial sweeteners, including steviol glycosides. Treated wastewater is typically discharged into rivers, which ultimately flow into oceans, introducing these sweeteners into marine environments. Other major sources are agricultural runoff, industrial effluents and storm water runoff. Once steviol glycosides are in the marine environment, they can be taken up by marine organisms directly from the water or through the food chain.

Preliminary research suggests that steviol glycosides may have a low environmental persistence due to their biodegradability [1]. However, this does not preclude their potential for bioaccumulation and adverse effects on marine organisms.

Insulin-Mimetic and Antioxidant Effects

Studies have shown that steviol glycosides exhibit insulin-mimetic effects in non-transformed cell systems, such as rat cardiac fibroblasts [2]. These effects are mediated through the activation of the PI3K/Akt pathway, leading to increased glucose uptake and translocation of Glut4 to the plasma membrane. Additionally, steviol glycosides have been found to possess antioxidant properties, increasing intracellular levels of reduced glutathione and upregulating the expression and activity of antioxidant enzymes [2]. These findings suggest that steviol glycosides may have potential beneficial effects in the co-treatment of diabetes and in promoting overall health.

Toxicity and Safety

The safety of high purity steviol glycosides has been extensively reviewed by national and international food safety agencies [2]. Sub chronic toxicity studies have shown no adverse effects at dose levels supporting a significantly higher acceptable daily intake (ADI) for steviol glycosides [3]. The only effects noted in animal toxicity studies were related to decreases in body weight gain, which have been observed with other sweetener products as a result of palatability and caloric reduction [3]. This suggests that steviol glycosides are safe for human consumption, but their potential effects on marine life remain unknown.

Environmental Impact

While there is limited research specifically on the effects of steviol glycosides on marine life, studies have highlighted the risks posed by other substances, such as cigarette litter, to aquatic organisms [4]. Cigarette filters, which contain toxicants, can bioaccumulate in marine worms and have detrimental effects on

aquatic life. Therefore, it is important to consider the potential environmental impact of substances like steviol glycosides on marine ecosystems.

Effects on Marine Microorganisms

Marine microorganisms play a significant role in nutrient cycles and energy flow in aquatic ecosystems. Research has shown that steviol glycosides can inhibit bacterial growth (antiproliferative), including marine bacteria [5]. This inhibition could disrupt the balance of marine microbial communities and potentially influence broader ecosystem functions.

Despite the growing use of steviol glycosides, there is a lack of robust environmental monitoring. Improved detection methods and regular monitoring are needed to understand the extent and impact of these sweeteners in marine environments. Future research should focus on understanding the fate and behavior of steviol glycosides in marine systems, including their degradation, bioaccumulation potential, and toxicity to various marine organisms. Studies should also consider the impact of these sweeteners under different environmental conditions, such as varying temperatures, salinities, and pH levels, which could influence their degradation and toxicity.

Conclusion

In conclusion, while steviol glycosides have been extensively studied for their antioxidant and antiproliferative effects in cancer cell lines, their potential effects on marine life remain largely unknown. The insulin-mimetic and antioxidant properties of steviol glycosides suggest potential beneficial effects in the co-treatment of diabetes and in promoting overall health. However, further research is needed to assess the potential impact of steviol glycosides on marine ecosystems and to understand their interactions with other environmental factors. This knowledge will contribute to the development of appropriate policies to protect marine life.

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