BIOACTIVE LIPID POTENTIAL OF Pavlova sp.TH03 AND Thalassiosira sp. TH06 MICROALGAE FOR COSMECEUTICAL DEVELOPMENT

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Received: 27/10/2025; Reviewed: 11/11/2025; Revised: 19/11/2025; Accepted: 25/12/2025
DOI: *https://doi.org/10.58902/nckhpt.e-v1i1.305*

Abstract: *Natural microalgae derived lipids represent a valuable source of bioactive compounds for next generation cosmeceuticals. This study evaluated the bioactive lipid potential of two marine microalgae, Pavlova sp. TH03 and Thalassiosira sp. TH06, focusing on their growth performance, lipid productivity, and fatty acid composition. Both strains were cultivated in F/2 medium, total lipids were extracted using the Bligh and Dyer method, and fatty acid profiles were determined via GC-MS. Pavlova sp. TH03 demonstrated superior growth (0.23 ± 0.03 day^{-1}), biomass yield (0.235 ± 0.065 g/L), and lipid content (23.54 ± 0.72%), characterized by a high proportion of polyunsaturated fatty acids (PUFAs, 43.76%), predominantly eicosapentaenoic acid (EPA, 18.37%), linoleic acid (2,56%) and linolenic acid (1,75%). The presence of arachidonic acid (AA) and docosahexaenoic acid (DHA) in Pavlova sp. TH03 was confirmed, accounting for 0.29% and 0.98% of the total fatty acids, respectively. Thalassiosira sp. TH06 exhibited a balanced lipid profile with 13.91% monounsaturated (MUFA) and 14.17% PUFA, containing notable levels of linolenic acid (8.78%) and EPA (2.46%). These omega-3 fatty acids possess well documented anti-inflammatory, antioxidant, and skin barrier supportive functions, making them relevant for skincare formulations. Overall, the results highlight Pavlova and Thalassiosira as promising renewable sources of bioactive lipids for sustainable cosmeceutical development.*

Keywords: *Cosmeceutical; Lipid; Pavlova; PUFA; Thalassiosira; Microalgae.*

1. Introduction

The cosmetics and personal care industry is increasingly shifting toward natural, safe, and sustainable ingredients in response to consumer demand and environmental challenges. Conventional raw materials often derived from petrochemical sources or terrestrial plants face significant limitations including resource depletion, ecological impact, and questionable long-term sustainability (Shahidi & Ambigaipalan, 2018). As a consequence, alternative renewable resources that offer multifunctional bioactive properties are being actively sought to support the development of next generation cosmeceuticals.

Marine microalgae are unicellular photosynthetic organisms that have recently gained attention as promising sources of bioactive metabolites, including pigments, polysaccharides, vitamins and importantly for this study lipids rich in polyunsaturated fatty acids (PUFAs). Unlike terrestrial crops, microalgae can be cultivated on non-arable land, use seawater rather than fresh water, and contribute to carbon dioxide sequestration, thereby offering both environmental and economic advantages (Borowitzka, 2013). Furthermore, their cultivation is highly scalable and strains can be selected or genetically enhanced to produce targeted compounds, making them attractive candidates for sustainable biorefineries (De Luca et al., 2021).

Among bioactive lipids, omega-3 and omega-6 PUFAs such as eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), arachidonic acid (AA), and linolenic acid are of particular interest in dermatology and cosmeceutical science (Ahmad et al., 2025; Prates, 2025). These fatty acids have been demonstrated to modulate inflammatory pathways, enhance skin barrier

function, reduce oxidative stress and improve hydration. For instance, topical or oral formulations enriched with EPA and DHA show protective effects against UV induced erythema and photoaging, while linolenic acid contributes to the maintenance of epidermal integrity and antioxidative defence (Mateu Arrom et al., 2025). These health promoting properties underscore the growing demand for PUFA rich oils in high value cosmeceutical formulations.

Despite the strong potential, previous research has primarily focused on microalgae applications in aquaculture and nutraceuticals rather than in cosmeceuticals. While antioxidant and anti-inflammatory potentials of microalgal extracts (fatty acids, carotenoids, polyphenols) have been highlighted in recent reviews (Bi et al., 2022; De Luca et al., 2021), comparative studies specifically exploring growth characteristics, lipid yields, and detailed fatty acid compositions of strains such as *Pavlova* and *Thalassiosira* in the context of cosmeceutical development remain limited.

Therefore, this study investigates two marine microalgae strains *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06 focusing on growth performance, total lipid productivity and fatty acid profiles. By evaluating their potential as natural, renewable sources of bioactive lipids for skincare and cosmetic applications, this work aims to contribute to the sustainable development of the cosmetic industry.

2. Research overview

Recent investigations into microalgal lipids for cosmetic applications have expanded significantly (Bi et al., 2022; Borowitzka, 2013; De Luca et al., 2021; Prates, 2025; Yang et al., 2020). De Luca et al. (2021) highlighted that microalgae accumulate appreciable quantities of lipids and various lipid classes useful in cosmetic formulations as moisturizing and delivery systems, emollients and color/fragrance carriers (De Luca et al., 2021). Yang et al. (2020) analysed ten microalgae species for total lipids, lipid class and PUFA content, finding considerable variation even within the same genus; notably, *Pavlova lutheri* exhibited 28% total n-3 PUFA with EPA 17.8% (Yang et al., 2020). This supports *Pavlova* as a high potential strain for lipid production (Yang et al., 2020).

Bi et al. (2022) reviewed microalgae-derived biomolecules for topical applications, identifying fatty acids among key actives for skin health (Bi et al., 2022). Ahmad et al. (2025) further emphasised that algal lipids are underexplored in cosmetics despite their nutraceutical effects (Ahmad et al., 2025). Smaller scale studies such as Shah et al. (2014) on *Pavlova lutheri* demonstrated that culture conditions (salinity, photoperiod, pH) significantly influence lipid content and fatty-acid composition (Shah et al., 2014). Collectively, these studies indicate that marine microalgae particularly *Pavlova* and *Thalassiosira* offer viable lipid profiles for skin care development, yet comparative application focused research is still scarce.

The studies specifically analysing fatty acid profiles of *Pavlova* and *Thalassiosira* microalgae further underscore their suitability for cosmeceutical lipid production. Yang et al. (2020) employed gas chromatography and lipid class quantification to examine ten microalgal species (Yang et al., 2020). Among them, *Pavlova lutheri* exhibited the highest level of total n-3 PUFA (28.0% of total fatty acids) with EPA at 17.8%, and DHA at 7.6% (Meireles et al., 2003). Meanwhile, *Thalassiosira* species have demonstrated EPA levels in the range of 16 - 30% of total fatty acids, signifying that diatoms of this genus are effective long-chain omega-3 producers (Nguyen, 2018).

In methodological terms, these works typically utilised Gas Chromatography - Mass Spectrometry (GC-MS) or Gas Chromatography - Flame Ionization Detector (GC-FID) to measure fatty acid methyl esters (FAME) after Bligh & Dyer or comparable extraction methods, followed by quantification of saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA) fractions (Nguyen, 2018; Yang et al., 2020). The adoption of lipid class separation (neutral lipids, glycolipids, phospholipids) in *Pavlova lutheri* by Meireles et al. (2003) also revealed that triacylglyceride triacylglycerols (TAGs) and monogalactosyl diacylglycerols (MGDGs) accumulate significant EPA and DHA, strengthening its value for high purity lipid recovery (Meireles et al., 2003).

Together, these results provide strong precedent: *Pavlova* offers a high proportion of

long chain PUFAs in a flagellate form, while *Thalassiosira* delivers robust diatom-based production of C20 PUFAs. Building on these studies, our current work adapts the established GC-MS fatty acid profiling paradigm to two marine strains (*Pavlova* sp. TH03 and *Thalassiosira* sp. TH06), enabling direct comparison of growth performance, lipid yield and fatty acid composition specifically tailored toward cosmeceutical lipid source identification.

3. Research methods

3.1. Microalgae cultivation

Pavlova sp. TH03 and *Thalassiosira* sp. TH06 isolated from Giao Thuy mangrove forest, Namdinh. Two marine strain were cultured in 500 mL Erlenmeyer flasks containing F/2 medium at 25–30 °C, under a 12:12 h light/dark cycle with continuous aeration. Light intensity was maintained at 10,000–20,000 Lux. Cultures were maintained for 16 days, with cell counts determined every 2 days using a Neubauer chamber. Growth rate was calculated as:

$$k = \frac{\ln \frac{N_{16}}{N_0}}{t_{16} - t_0}$$

k: growth rate (day^{-1});

N_0: initial cell density (cells. mL^{-1}) at the beginning of the experiment (t_0);

N_{16}: final cell density (cells. mL^{-1}) after 16 days of cultivation (t_{16});

t_0 and t_{16}: initial and final cultivation times (days), respectively.

3.2. Determination of total lipid content

The total lipid content was determined according to the method of Bligh and Dyer (1959) with slight modifications (Bligh & Dyer, 1959). Briefly, the dried biomass sample was weighed (m_1, g) and extracted with a chloroform:methanol (1:2, v/v) mixture for 6 hours under continuous agitation. The extract was then filtered to remove the residue, and the resulting filtrate was collected as the first extract. Subsequently, 100 mL of distilled water was added to the combined extract, and the mixture was thoroughly shaken to obtain the second extract. After complete phase separation, the lower chloroform layer was collected and dried over anhydrous sodium sulfate (Na_2SO_4). The solvent was evaporated under reduced pressure to obtain the total lipid fraction, which was weighed (m_2, g).

The total lipid content was calculated using the following formula and expressed as a percentage of the sample's dry weight:

$$Total\ lipid\ content\ (\%\ dry\ weight) = \frac{m_2}{m_1} \times 100$$

3.3. Analysis of fatty acid composition

Fatty acid composition was analyzed according to the ISO/FDIS 5590:1998 (Germany) standard. In brief, 10 mg of the extracted lipid was dissolved in 1 mL of n-hexane and thoroughly mixed in a sealed vial. Then, 25 µL of 2 M sodium methoxide (CH_3ONa) in methanol was added, and the mixture was vigorously shaken for 1 minute to facilitate methyl ester formation. Next, 1 mL of distilled water was added, and the solution was centrifuged at 3000 rpm to separate the phases. The lower unreacted wax layer was removed. Subsequently, 100 µL of HCl was added, followed by shaking and centrifugation at 3000 rpm to complete the methylation process. The lower residue was discarded, and the upper solvent layer was dried over anhydrous Na_2SO_4 and centrifuged again.

The methylated fatty acid sample was then analyzed using gas chromatography–mass spectrometry (GC–MS) (HP 6890 GC coupled with an Agilent 5973 Mass Selective Detector) equipped with an HP-5MS column (0.25 µm × 30 m × 0.25 mm). Helium was used as the carrier gas. The oven temperature program was set as follows: 80 °C (1 min), increased at 40 °C/min to 150 °C (1 min), then 10 °C/min to 260 °C (10 min). Fatty acid methyl esters (FAMEs) were identified by comparing their mass spectra with those in the WILEY275.L and NIST 98.L libraries.

4. Research results

4.1. Growth and lipid production

Both *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06 exhibited active growth under F/2 culture conditions, indicating good adaptation to the medium composition (Table 1). *Pavlova* sp. TH03 achieved the highest growth rate (0.23 ± 0.03 day^{-1}), dry biomass (0.235 ± 0.065 g/L), and lipid content (23.54 ± 0.72%). *Thalassiosira* sp. TH06 displayed moderate growth (0.21 ± 0.02 day^{-1}) and lipid content (19.83 ± 0.91%) with biomass of 0.206 ± 0.021g/L.

The higher growth rate and lipid accumulation observed in *Pavlova* sp. TH03 suggest its superior photosynthetic efficiency and carbon assimilation capacity compared to *Thalassiosira* sp. TH06. These findings align with previous studies reporting *Pavlova* species as high lipid producers, particularly rich in polyunsaturated fatty acids (PUFAs) (Meireles et al., 2003). Meanwhile, *Thalassiosira* sp. TH06 demonstrated moderate growth and lipid content, consistent with its diatom characteristics typically favoring balanced synthesis between structural lipids and storage lipids.

The distinct growth and biochemical responses between the two species may reflect their taxonomic and physiological differences, including cell wall structure and nutrient utilization strategies. Overall, the results highlight *Pavlova* sp. TH03 as a promising candidate for lipid-based applications, while *Thalassiosira* sp. TH06 offers potential for producing balanced lipid profiles valuable in cosmeceutical formulations.

Table 1. Growth of Pavlova sp. TH03 và Thalassiosira sp. TH06 on F/2 medium

Species	N_0 ($\times 10^5$/mL)	N_{16} ($\times 10^5$/mL)	Growth rate k (day^{-1})	Biomass (g/L)	Lipid content (%)
Pavlova sp. TH03	5.2 ± 0.19	124.2 ± 0.75	0.23 ± 0.03	0.235 ± 0.065	23.54 ± 0.72
Thalassiosira sp. TH06	3.5 ± 0.12	76.8 ± 0.59	0.21 ± 0.02	0.206 ± 0.021	19.83 ± 0.91

4.2. Fatty acid composition

The fatty acid profiles of *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06 are presented in Table 2 and Figure 1, 2. Both species contained fatty acids ranging from C12 to C22, including saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA).

Pavlova sp. TH03 exhibited a high proportion of PUFA (43.76% of total FA), dominated by eicosapentaenoic acid (EPA, 18.37%), along with linoleic acid (2.56%) and linolenic acid (1.75%). Its MUFA fraction accounted for 31.77%, with palmitolic acid as a major contributor (29.94% relative to total MUFA), while SFA were lower than in *Thalassiosira*, mainly palmitic acid (17.36%) (Figure 1). In contrast, *Thalassiosira* sp. TH06 displayed a balanced lipid profile with MUFA (13.91%) and PUFA (14.17%), including linolenic acid (8.78%), EPA (2.46%), and linoleic acid (2.93%). This strain also showed higher levels of SFA compared to *Pavlova*, dominated by palmitic acid (40.25%) and myristic acid (15.46%) (Tabble 2*). Pavlova* sp. TH03 contains a small amount of AA (arachidonic acid, 0.29%) DHA (Docosahexaenoic Acid 0.98%) while *Thalassiosira* sp. TH06 does not (Figure 2). These findings demonstrate that *Pavlova* sp. TH03 is particularly rich in EPA, making it a promising candidate for anti-inflammatory cosmeceutical applications, while *Thalassiosira* sp. TH06 offers a broader spectrum of omega-3 and omega-6 fatty acids relevant for antioxidant and skin barrier support.

The results revealed significant differences in fatty acid composition between *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06, with important implications for cosmeceutical applications. *Pavlova* sp. TH03 contained the highest proportion of PUFA (43.76%), particularly EPA (18.37%). EPA is known to modulate pro-inflammatory eicosanoids, reduce erythema, and improve skin elasticity (Meireles et al., 2003; Prates, 2025; Shah et al., 2014). Its relatively high lipid yield (23.54%) further enhances its industrial applicability, making *Pavlova* an attractive source for cosmeceutical formulations targeting anti-aging and anti-inflammatory skincare.

Thalassiosira sp. TH06 demonstrated a balanced MUFA/PUFA profile. The notable presence of linolenic acid (8.78%) supports antioxidant defense mechanisms and reduces oxidative stress, a major contributor to skin aging (De Luca et al., 2021). In addition, oleic acid and linoleic acid contribute to hydration and skin barrier repair, highlighting *Thalassiosira* as a versatile candidate for moisturizing and protective formulations. *Pavlova* sp. TH03 is an EPA rich

strain suited for anti-inflammatory products, whereas *Thalassiosira* sp. TH06 offers a broader spectrum of omega-3 and omega-6 fatty acids suitable for antioxidant and barrier repairing applications. The analysis also showed that both species contain fatty acids that are beneficial to the skin (such as oleic, linoleic) without bad acids (animal cholesterol), in line with the trend of using natural ingredients.

The distinct fatty acid signatures of these microalgae support their use in tailored cosmeceutical applications. Furthermore, cultivation of marine microalgae provides a renewable alternative to fish oil as a source of omega-3 fatty acids, aligning with sustainability and clean label trends in the cosmetic industry (Borowitzka, 2013; De Luca et al., 2021; Mateu Arrom et al., 2025).

Figure 1. Fatty acid distribution in Pavlova sp. TH03 and Thalassiosira sp. TH06

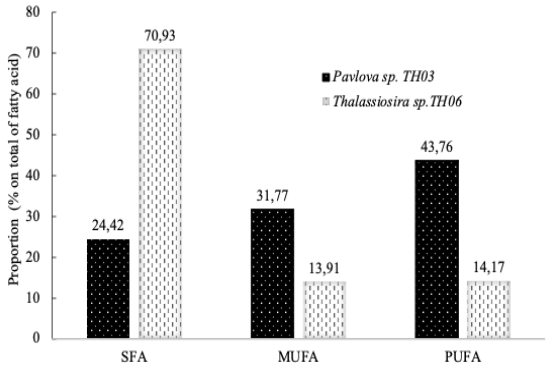
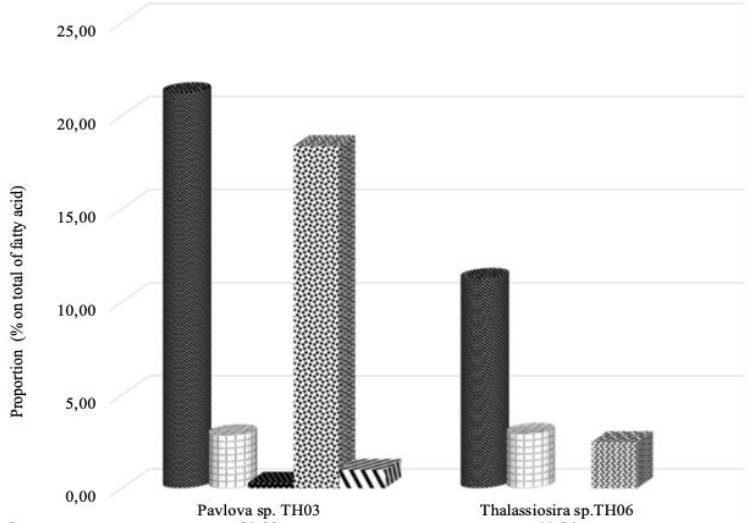


Table 2. Fatty acid composition of Pavlova sp. TH03 and Thalassiosira sp. TH06

Fatty acid		Proportion (% on total of fatty acid)	
		Pavlova sp. TH03	*Thalassiosira* sp.TH06
Saturated Fatty Acid-SFA			
C12:0	Dodecanoic (Lauric)	-	5.40
C14:0	Tetradecanoic (Myristic Acid)	5.92	15.46
C16:0	Palmitic Acid	17.36	40.25
C18:0	Stearic Acid	1.14	0.29
C20:0	Eicosanoic (Arachidic)	-	3.08
C22:0	Docosanoic (behenic acid)	-	2.51
C24:0	Tetracosanoic (Lignoceric)	-	3.94
	Total of SFA	**24.42**	**70.93**
Mono Unsaturated Fatty Acid-MUFA			
C16:1	Palmitolic Acid	29.94	7.05
C18:1	Oleic Acid	1.83	6.86
	Total of MUFA	**31.77**	**13.91**
Poly Unsaturated Fatty Acid-PUFA			
C16:2	-	8.45	-
C16:3	-	4.41	-
C18:2	Linoleic Acid (omega-6)	2.56	2.93
C18:3	Linolenic Acid (omega-3)	1.75	8.78
C18:4	Octadecatetraenoic	1.83	-
C20:4n-3	Eicosatetraenoic Acid (ETA) (omega-3)	0.12	-
C20:4n-6	Arachidonic Acid (AA) (omega-6)	0.29	-
C20:5n-3	Eicosapentaenoic Acid (EPA) (omega-3)	18.37	2.46
C22:6	Docosahexaenoic Acid (DHA) (omega-3)	0.98	-
	Total of PUFA	**43.76**	**14.17**

Figure 2. Distribution of omega-3 and omega-6 fatty acids, and comparison of AA, EPA, and DHA in Pavlova sp. TH03 and Thalassiosira sp. TH06



	Pavlova sp. TH03	Thalassiosira sp.TH06
Total of Omega 3	21,22	11,24
Total of Omega 6	2,85	2,93
Arachidonic acid (AA)	0,29	
Eicosapentaenoic Acid (EPA)	18,37	2,46
Docosahexaenoic Acid (DHA)	0,98	

5. Discussion

The results of this study reveal notable distinctions in both growth performance, lipid yield, and fatty acid composition between *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06, which bear significant implications for their utility in cosmeceutical applications. In terms of growth metrics and lipid productivity, *Pavlova* sp. TH03 achieved the highest specific growth rate (0.23 ± 0.03 day^{-1}), biomass (0.235 ± 0.065 g/L) and lipid content (23.54 ± 0.72 %), outperforming *Thalassiosira* sp. TH06 (growth rate 0.21 ± 0.02 day^{-1}, biomass 0.206 ± 0.021 g/L, lipid content 19.83 ± 0.91 %). The superior performance of *Pavlova* sp. TH03 suggests more efficient assimilation of carbon and nutrient resources under the F/2 medium conditions, potentially attributable to physiological traits such as flagellate motility and thinner cell walls that favour faster growth and lipid accumulation. These data align with general findings in microalgal biotechnology that higher productivity strains are prerequisites for a viable lipid based ingredient supply chain (Ahmad et al., 2025; Bi et al., 2022; De Luca et al., 2021).

When integrating growth/lipid yield with fatty acid composition, the contrast becomes even more functionally meaningful. *Pavlova* sp. TH03's lipid fraction comprised 43.76 % polyunsaturated fatty acids (PUFA), with eicosapentaenoic acid (EPA) at 18.37 %, linoleic acid at 2.56 % and linolenic acid at 1.75 %. Its monounsaturated fatty acid (MUFA) portion was 13.91 % (dominated by palmitolic acid at 29.94 % of MUFAs) and saturated fatty acids (SFA) were lower relative to the diatom strain. In contrast, *Thalassiosira* sp. TH06 exhibited a balanced MUFA/PUFA profile (MUFA 13.91 %, PUFA 14.17 %) including linolenic acid (8.78 %) and EPA (2.46 %), while presenting markedly higher SFA levels (dominated by palmitic acid 40.25 % and myristic acid 15.46 %). These divergent lipid signatures reflect fundamentally different metabolic strategies: *Pavlova* favouring biosynthesis of long chain omega-3 PUFA (notably EPA) and *Thalassiosira* maintaining a higher structural lipid, saturated backbone with greater MUFA flexibility.

Omega-3 polyunsaturated fatty acids (PUFAs), such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), derived from microalgae, are known to inhibit inflammatory processes by incorporating into cell membranes and being metabolized into resolvins, protectins, and maresins. These bioactive mediators compete with arachidonic acid (AA) to reduce the production of pro-inflammatory prostaglandins

and leukotrienes, while simultaneously suppressing NF-κB and MAPK signaling pathways and stimulating the anti-inflammatory cytokine IL-10. This anti-inflammatory activity helps prevent oxidative stress–induced and infection-related skin aging (Prates, 2025).

Linoleic acid (LA, ω-6), though present in low amounts in the samples, is an essential component of ceramides in the stratum corneum, contributing to skin hydration and barrier function (Ahmad et al., 2025; Nguyen, 2018). Oleic acid (MUFA), although less potent in antioxidative capacity compared to PUFAs, acts as an emollient and enhances epidermal permeability, facilitating the penetration of other bioactive compounds. Alpha-linolenic acid (ALA, short-chain ω-3), found in both *Pavlova* and *Thalassiosira*, can serve as a precursor for endogenous biosynthesis of EPA and DHA and exhibits mild anti-inflammatory effects. Arachidonic acid (AA, long-chain ω-6), detected only in trace amounts in *Pavlova* (0.29%), suggests that pro-inflammatory activity associated with AA is limited in these strains; moreover, AA may also act as a precursor to balance eicosanoid synthesis (Borowitzka, 2013; Meireles et al., 2003; Prates, 2025).

These findings represent a preliminary assessment based on GC analysis of fatty acid composition, highlighting the lipid potential of *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06 isolated from Vietnam. Further studies should verify their direct bioactivities and perform in vitro/in vivo evaluations to confirm anti-inflammatory, antioxidant, and nutritive effects of the microalgal extracts. Although still in an early stage, the study demonstrates that *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06 possess beneficial fatty acid profiles comparable to fish oil but from a more sustainable source. Utilizing microalgal lipids avoids heavy metal contamination risks and aligns with the clean-label and natural ingredient trends. As noted by De Luca et al. (2021), microalgal fatty acids possess high-value antioxidant and health promoting properties applicable in cosmetics. Moreover, microalgae can be cultivated on a large scale without competing for arable land, fitting well within the current ecological paradigm (De Luca et al., 2021). These insights support the substitution of conventional oils with EPA/DHA-rich microalgal oils in anti-aging, moisturizing, and barrier-restoring formulations, contributing to the development of "green" and sustainable cosmetic ingredients for the future.

6. Conclusions

This study provides a comprehensive evaluation of the bioactive lipid potential of two marine microalgae, *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06, for sustainable cosmeceutical development. Both strains demonstrated promising growth and lipid production profiles under F/2 culture conditions, confirming their suitability for scalable cultivation. *Pavlova* sp. TH03 exhibited superior growth rate, biomass, and lipid content, alongside a distinct enrichment in EPA (18,37 % TFA), positioning it as a valuable source of omega-3 PUFA (21,11% TFA) for anti-inflammatory and anti-aging skincare formulations. In contrast, *Thalassiosira* sp. TH06 displayed a balanced fatty acid spectrum, rich in linolenic acid (8,78% TFA) and moderate EPA levels (2,46% TFA), offering multifunctional benefits for antioxidant defense and skin barrier restoration.

The observed diversity in fatty acid composition between these species highlights the potential to tailor microalgal lipid production toward specific cosmeceutical applications. Such differentiation can be further enhanced through culture optimization, nutrient modulation, or light induced metabolic regulation to favor targeted lipid accumulation. Importantly, the marine origin and renewable cultivation of *Pavlova* and *Thalassiosira* present environmentally responsible alternatives to conventional omega-3 sources, supporting the emerging "green cosmeceutical" paradigm.

Overall, these findings establish *Pavlova* sp. TH03 and *Thalassiosira* sp. TH06 as complementary microalgal resources for next generation cosmeceutical formulations. Their distinctive lipid profiles EPA rich versus balanced MUFA/PUFA offer functional versatility that aligns efficacy, sustainability, and innovation in cosmetic ingredient development.

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TIỀM NĂNG LIPID HOẠT TÍNH SINH HỌC TỪ VI TẢO Pavlova sp.TH03 VÀ Thalassiosira sp. TH06 CHO PHÁT TRIỂN DƯỢC MỸ PHẨM

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Ngày nhận bài: 20/10/2025; Ngày phản biện: 11/11/2025; Ngày tác giả sửa: 19/11/2025;
Ngày duyệt đăng: 25/12/2025
DOI: *https://doi.org/10.58902/nckhpt.e-v1i1.305*

Tóm tắt: *Lipid tự nhiên có nguồn gốc từ vi tảo là nguồn hợp chất hoạt tính sinh học quý giá cho các sản phẩm dược mỹ phẩm thế hệ mới. Nghiên cứu này đánh giá tiềm năng lipid hoạt tính sinh học của hai loài vi tảo biển Pavlova sp. TH03 và Thalassiosira sp. TH06, tập trung vào khả năng sinh trưởng, năng suất lipid và thành phần acid béo. Cả hai chủng được nuôi cấy trong môi trường F/2, lipid tổng được chiết tách theo phương pháp Bligh và Dyer, và thành phần acid béo được phân tích bằng GC-MS. Pavlova sp. TH03 thể hiện khả năng sinh trưởng vượt trội 0.23 ± 0.03/ngày, sinh khối đạt 0.235 ± 0.065 g/L và hàm lượng lipid 23.54 ± 0.72%, trong đó acid béo không bão hòa đa nối đôi (PUFA) chiếm tỷ lệ cao (43,76%), chủ yếu là eicosapentaenoic acid (EPA, 18,37%), linoleic acid (2,56%) và linolenic acid (1,75%). Sự hiện diện của arachidonic acid (AA) và docosahexaenoic acid (DHA) trong Pavlova sp. TH03 đã được phát hiện, với tỷ lệ tương ứng là 0,29% và 0,98% tổng hàm lượng acid béo. Thalassiosira sp. TH06 có tỷ lệ lipid cân bằng với 13,91% acid béo không bão hòa đơn (MUFA) và 14,17% PUFA, chứa lượng đáng kể linolenic acid (8,78%) và EPA (2,46%). Các acid béo omega-3 này được biết đến với đặc tính chống viêm, chống oxy hóa và hỗ trợ hàng rào bảo vệ da, có giá trị ứng dụng trong các công thức chăm sóc da. Kết quả cho thấy Pavlova và Thalassiosira là có nguồn lipid hoạt tính sinh học bền vững, tiềm năng cho phát triển dược mỹ phẩm tự nhiên.*

Từ khóa: *Dược mỹ phẩm; Lipid; Pavlova; PUFA; Thalassiosira; Vi tảo.*