

*Unlocking the potential of macroalgae for a thriving European blue bioeconomy*



## Product analysis incl. food safety, microbiology, heavy metal, iodine and allergen

SEAMARK DELIVERABLE 3.4  
OCEANIUM Ltd.



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# SEAMARK DELIVERABLE 3.4: PRODUCT ANALYSIS INCL. FOOD SAFETY, MICROBIOLOGY, HEAVY METAL, IODINE, AND ALLERGEN

OPEN ACCESS

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**Abstract**

Oceanium manufactured six industrial-scale batches (Aug–Oct 2024) of three *Saccharina latissima* ingredients: high-purity fucoïdan (**OCEAN ACTIVES® H<sup>+</sup> / C<sup>+</sup>**), laminarin-rich **OCEAN ACTIVES® Beta-glucan Plus**, and functional fibre (**OCEAN HEALTH NUTRA™ / OCEANIUM® PET**). Accredited laboratories measured microbiology, heavy metals, iodine, allergens and composition.

- All powders were pathogen-free and met EU or ISO microbiological limits.
- Lead, cadmium, mercury and inorganic arsenic were at least ten-fold below Regulation (EU) 2023/915 maxima.
- A typical consumer portion delivers ≤80 µg iodine for fucoïdan, ≤1.6 mg for beta-glucan and ~1.1 mg bioaccessible iodine for fibre – all within the EFSA tolerable upper limit (600 µg day<sup>-1</sup>) when label guidance is followed.
- Allergen residues were undetectable or << VITAL action limits; precautionary labelling is not required.
- Purities averaged >90 % fucoïdan, 66 % laminarin and 62 % AOAC fibre.

These findings confirm the ingredients are safe for food, nutraceutical, cosmetic and biomaterial applications.

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## LIST OF ABBREVIATIONS

Abbreviation	Description
AOAC	Association of Official Analytical Collaboration (AOAC) International
APC	Aerobic Plate Count
As	Arsenic
Cd	Cadmium
dm	Dry matter
EFSA	European Food Safety Authority
ELISA	Enzyme-Linked Immunosorbent Assay
GIT	Gastrointestinal tract
Hg	Mercury
iAs	Inorganic Arsenic
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
IgE	Immunoglobulin E
ISO	International Organization for Standardization
ND	Not Detected
Pb	Lead
VITAL	Voluntary Incidental Trace Allergen Labelling

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# 1. INTRODUCTION

The SeaMark consortium is scaling European seaweed cultivation and valorisation. OCEANIUM leads the biorefinery work-package (WP3), converting farmed *Saccharina latissima* into high-value fractions. This public report summarises non-confidential safety data from six representative production batches.

Table 1. Why each parameter matters and legal benchmarks.

Parameter	Safety rationale	Key EU / ISO benchmark
Microbiology	Pathogens such as <i>Salmonella</i> or <i>Listeria</i> cause acute illness; total counts reflect hygienic control	Reg. (EC) 2073/2005 – absence in 25 g for target pathogens; ISO 17331 (food algae) $\leq 1 \times 10^5$ cfu g <sup>-1</sup> ; ISO 17516 (cosmetics) $< 10^3$ cfu g <sup>-1</sup>
Heavy metals (Pb, Cd, Hg, iAs)	Chronic exposure damages nervous system, kidneys; inorganic As is carcinogenic	Reg. (EU) 2023/915: Pb 3 mg kg <sup>-1</sup> , Cd 3, Hg 0.1, iAs 2 for dried algae supplements
Iodine	Essential micronutrient; excess ( $> 600 \mu\text{g day}^{-1}$ ) disrupts thyroid	EFSA UL 600 $\mu\text{g day}^{-1}$ ; Recommendation (EU) 2018 /464 encourages monitoring; France advises $\leq 2000 \text{ mg kg}^{-1}$ in dry algae
Allergens (fish, crustacea, mollusc)	Trace proteins can trigger IgE-mediated reactions	VITAL 3.0 action levels: fish 24 mg, crustacea 4 mg per reference amount
Composition & purity	Demonstrates enrichment of the intended bioactive and absence of unknown materials	Internal specs $\geq 80\%$ fucoidan, $\geq 50\%$ laminarin, $\geq 50\%$ AOAC fibre

## 1.2 Accredited analytical methods

- Aerobic count, yeast & mould, *Enterobacteriaceae*, *E. coli*, *Salmonella*, *Listeria monocytogenes*, *Bacillus cereus*. (MS Labs, Wellingborough, UK).
- Pb, Hg, Cd, total As and inorganic As by ICP-MS. (FERA, York, UK).
- Total iodine and bioaccessibility by ICP-MS & validated upper-GIT model. (ProDigest, Gent, Belgium).
- Fish, crustacean and mollusc allergens by ELISA. (MS Labs, Wellingborough, UK. Eurofins, Wolverhampton, UK).
- Composition & purity by monosaccharide and elemental analysis plus specific enzymatic kits. (Celignis, Limerick, Ireland).

# 2. OCEAN ACTIVES® H<sup>+</sup>/C<sup>+</sup> (FUCOIDAN)

**OCEAN ACTIVES® H<sup>+</sup> / C<sup>+</sup>** is a marine bioactive ingredient rich in fucoidan ( $> 75\%$ ) derived from sustainably sourced brown seaweed and extracted using proprietary green processing methods. **OCEAN ACTIVES® H<sup>+</sup>** is a valuable prebiotic nutritional supplement and functional food ingredient. **OCEAN ACTIVES® C<sup>+</sup>** is valuable skincare bioactive ingredient Ideal for formulations targeting sensitive, irritated, acne-prone skin, and rosacea.

## Composition & purity

Mean fucoidan purity 90 % dry matter (dm) (protein  $\leq 6\%$ ).

## Microbiology

Water activity  $\leq 0.14$ . Aerobic counts  $8 \times 10^2 - 1 \times 10^4$  cfu g<sup>-1</sup>; pathogens absent.

## Heavy metals & iodine

Pb 0.07, Cd 0.05, Hg  $< 0.01$ , iAs 0.15 mg kg<sup>-1</sup> – all  $\geq 10$ -fold below limits. Iodine 50–322 mg kg<sup>-1</sup>; a 250 mg dose provides  $\leq 80 \mu\text{g}$  (13 % UL).

## Allergens

Fish 0.729 mg kg<sup>-1</sup>; crustacea 1.9  $\mu\text{g kg}^{-1}$  –  $< 3\%$  of VITAL action level; no precautionary label required.

## Cosmetic compliance

OCEAN ACTIVES® C<sup>+</sup> met ISO 17516 Category 2  $< 10^3$  cfu g<sup>-1</sup>; three also met Category 1  $< 10^2$  cfu g<sup>-1</sup>. *S. Aureus*, *P. aeruginosa*, *C. albicans* and *E. Coli* were not detected.

Table 2. Safety summary – OCEAN ACTIVES® H<sup>+</sup> / C<sup>+</sup>.

Parameter	Product Measurement	Limit	Significance
Aerobic plate count	1 × 10 <sup>4</sup> cfu g <sup>-1</sup>	1 × 10 <sup>5</sup> cfu g <sup>-1</sup> (ISO 17331)	<10 % of limit, indicating excellent hygiene
ISO 17516 APC (C <sup>+</sup> )	9.2 × 10 <sup>2</sup> cfu g <sup>-1</sup>	<1 × 10 <sup>3</sup> cfu g <sup>-1</sup>	Cosmetic compliance achieved
Pathogens	ND in 25 g	Absence	Meets Reg. 2073/2005
Pb	0.07 mg kg <sup>-1</sup>	3 mg kg <sup>-1</sup>	40-fold margin
Cd	0.05 mg kg <sup>-1</sup>	3 mg kg <sup>-1</sup>	60-fold margin
Hg	<0.01 mg kg <sup>-1</sup>	0.1 mg kg <sup>-1</sup>	10-fold margin
iAs	0.15 mg kg <sup>-1</sup>	2 mg kg <sup>-1</sup>	>10-fold margin
Iodine	322 mg kg <sup>-1</sup>	Monitor >2 000 mg kg <sup>-1</sup>	Portion provides 13 % UL
Fish protein	0.729 mg kg <sup>-1</sup>	24 mg kg <sup>-1</sup>	<3 % of action level
Crustacean protein	1.9 µg kg <sup>-1</sup>	4 mg kg <sup>-1</sup>	Negligible
Fucoxanthin purity	90 %	≥80 %	Meets spec

### 3. OCEAN ACTIVES® BETA GLUCAN PLUS (LAMINARIN)

#### Composition & purity

Laminarin 66–82 % dm (mean 66 %).

#### Microbiology

Aerobic counts ≤80 cfu g<sup>-1</sup>; pathogens absent.

#### Heavy metals & iodine

Pb 0.106, Cd 0.09, Hg 0.007, iAs 0.15 mg kg<sup>-1</sup> – all far below limits. Iodine 25–322 mg kg<sup>-1</sup>; a 5 g dose provides ≤1.6 mg (label advises thyroid-sensitive consumers).

#### Allergens

Fish/crustacea proteins <0.02 mg kg<sup>-1</sup> (ELISA).

Table 3. Safety summary – OCEAN ACTIVES® Beta glucan Plus.

Parameter	Product Measurement	Limit	Significance
Aerobic plate count	80 cfu g <sup>-1</sup>	1 × 10 <sup>5</sup> cfu g <sup>-1</sup>	Extremely low
Pathogens	ND	Absence	Compliant
Pb	0.106 mg kg <sup>-1</sup>	3 mg kg <sup>-1</sup>	28-fold margin
Cd	0.09 mg kg <sup>-1</sup>	3 mg kg <sup>-1</sup>	33-fold margin
Hg	0.007 mg kg <sup>-1</sup>	0.1 mg kg <sup>-1</sup>	14-fold margin
iAs	0.15 mg kg <sup>-1</sup>	2 mg kg <sup>-1</sup>	Safe
Iodine	322 mg kg <sup>-1</sup>	Monitor >2 000 mg kg <sup>-1</sup>	Portion <3 × UL with label
Allergens	<0.02 mg kg <sup>-1</sup>	VITAL levels	Suitable for fish-free claim
Laminarin purity	66 %	≥50 %	Meets spec

### 4. OCEAN HEALTH NUTRA™ / OCEANIUM® PET (FIBRE)

**OCEAN HEALTH NUTRA™** is a prebiotic, functional superfood ingredient derived from sustainably sourced seaweed (*Saccharina latissima*) and extracted using green chemistry. **OCEANIUM® PET** is a unique, multi-complex extract offering a wealth of health benefits for pets.

#### Composition

AOAC dietary fibre 62 % dm; ash 25 % dm; alginate-rich profile.

#### Microbiology & allergens

Aerobic counts <1 × 10<sup>3</sup> cfu g<sup>-1</sup>; pathogens absent. Fish/crustacean/mollusc proteins <0.03 mg kg<sup>-1</sup>.

#### Heavy metals & iodine

Pb 0.30, Cd 0.05, Hg 0.024, iAs 0.05 mg kg<sup>-1</sup> – all compliant. Total iodine 605 mg kg<sup>-1</sup>; only 34 % becomes bioaccessible, so a 3.2 g serve supplies 0.68 mg.

#### Safety implication

A 5 g daily intake delivers ~1.1 mg bioaccessible iodine – within the European UL for short periods; label guidance advises max 5 g day<sup>-1</sup>.

Table 4. Safety summary – OCEAN HEALTH NUTRA™ / OCEANIUM® PET (fibre).

Parameter	Product Measurement	Limit	Significance
Aerobic plate count	1 × 10 <sup>3</sup> cfu g <sup>-1</sup>	1 × 10 <sup>5</sup> cfu g <sup>-1</sup>	Low
Pathogens	ND	Absence	Safe
Pb	0.30 mg kg <sup>-1</sup>	3 mg kg <sup>-1</sup>	10-fold margin
Cd	0.05 mg kg <sup>-1</sup>	3 mg kg <sup>-1</sup>	60-fold margin
Hg	0.024 mg kg <sup>-1</sup>	0.1 mg kg <sup>-1</sup>	4-fold margin
iAs	0.05 mg kg <sup>-1</sup>	2 mg kg <sup>-1</sup>	Safe
Total iodine	605 mg kg <sup>-1</sup>	Monitor >2 000 mg kg <sup>-1</sup>	Managed by serving size
Bioaccessible iodine	34 %	—	5 g serve ~1.1 mg
Allergens	<0.03 mg kg <sup>-1</sup>	VITAL levels	Fish-free claim
AOAC fibre	62 %	≥50 %	Meets spec

- Recommendation (EU) 2018/464 on monitoring metals & iodine in seaweed
- ISO 17331:2021 (dried algae), ISO 17516:2014 (cosmetics)

## DATA SETS

- Daily and weekly production data sets.
- Product analysis data sets.

## APPENDIX

- Annex 1: Product Information Sheet for OCEAN ACTIVES® H+
- Annex 2: Product Information Sheet for OCEAN ACTIVES® C+
- Annex 3: Product Information Sheet for OCEAN HEALTH NUTRA™
- Annex 4: Product Information Sheet for OCEANIUM® PET
- Annex 5: Product Information Sheet for OCEAN INK®

## 5. OCEAN INK®

**OCEAN INK®** is a 100% biodegradable ink which is a formulation of OCEANIUM's fibre product, developed to be suitable for screen printing and coating applications. There are no additional analytical parameters required for OCEAN INK® beyond those reported for OCEAN HEALTH NUTRA™ / OCEANIUM® PET.

## 6. CONCLUSION / SUMMARY

All three OCEANIUM ingredients comply with EU and ISO safety criteria. Heavy-metal and microbiological results show wide safety margins; iodine exposures are controllable with sensible serving sizes and clear labelling; allergen residues are negligible. These data support the safe use of the ingredients across food, nutraceutical, cosmetic and biomaterial applications.

## REFERENCES

### Key regulations referenced

- Regulation (EU) 2023/915 on maximum contaminants (replacing 1881/2006)
- Regulation (EC) 2073/2005 on microbiological criteria for foodstuffs

# OCEAN ACTIVES® H+

AN OCEANIUM® BRAND

## Product Information Sheet

- ✓ Improves beneficial microbiome mass and diversity
- ✓ Rich in antioxidant polyphenols
- ✓ End-to-end sustainable and traceable



### Product Description

**OCEAN ACTIVES® H+** is a marine bioactive ingredient rich in fucoidan (>75%) derived from sustainably sourced brown seaweed (*Saccharina latissima*) and extracted using clean and green chemistry.

### Typical Analysis

Carbohydrate including > 75% fucoidan	94%
Total dietary fiber	91%
Protein	5.5%
Microbiology	Complies
Residues of fish, molluscs and crustaceans may be present in seaweed before processing	



Certified  
vegan



Certified  
halal



Certified  
vegetarian



Certified  
kosher



Non  
GMO



Natural  
Origin



Water  
Soluble

### Applications

**OCEAN ACTIVES® H+** is a water-soluble powder, which can be used in supplements, food and beverages with a recommended daily dosage of 250mg-1g. GRAS approval in the US.

### Packaging & Storage

Available in 5kg and 10kg containers. Store in a cool, dry place in unopened packaging.

### Shelf Life

Best used within 24 months of manufacturing.



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# OCEANIUM®

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## Product Information Sheet

- ✓ Clinically proven to reduce redness by up to 96%
- ✓ Restored and enhances the skin barrier by 400%
- ✓ High antioxidant activity
- ✓ Clinically tested, with in vivo and in vitro validation
- ✓ End-to-end sustainable and traceable



### Product Description

**OCEAN ACTIVES® C+** is a marine bioactive ingredient rich in fucoidan (>80%) derived from sustainably sourced seaweed (*Saccharina latissima*) and extracted using proprietary green processing methods. Ideal for formulations targeting sensitive, irritated, acne-prone skin, and rosacea. INCI: Laminaria Saccharina Extract (34842)

### Typical Analysis

Carbohydrate including > 80% fucoidan	94%
Protein	5.5%
Microbiology	Complies
Residues of fish, molluscs and crustaceans may be present in seaweed before processing	



Certified  
vegan



Certified  
halal



Certified  
vegetarian



Certified  
kosher



China  
compliant



Non  
GMO



Low  
dosage



Natural  
Origin



Water  
Soluble



Ocean  
friendly

### Applications

Versatile for use in lotions, creams, treatments, face masks, sun care, and after-shave products. Recommended dosage: 1%.

### Packaging & Storage

Available in 5kg and 10kg containers. Store in a cool, dry place in unopened packaging.

### Shelf Life

Best used within 24 months of manufacturing.



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# OCEAN HEALTH

## NUTRA™

AN OCEANIUM® BRAND

### Product Information Sheet

- ✓ Functional superfood ingredient
- ✓ 10X water-holding capacity
- ✓ Clean label, plant-based & gluten-free
- ✓ Prebiotic - source of dietary fiber
- ✓ Rich in essential amino acids (8 out of 9)
- ✓ Rich in antioxidants for digestive health
- ✓ End-to-end sustainable and traceable



#### Product Description

**OCEAN HEALTH NUTRA™** is a prebiotic, functional superfood ingredient derived from sustainably sourced seaweed (*Saccharina latissima*) and extracted using clean and green chemistry.

#### Typical Analysis

Total dietary fiber	70 %
Protein	13 %
Microbiology	Complies
Residues of fish, molluscs and crustaceans may be present in seaweed before processing	



Certified  
vegan



Certified  
halal



Certified  
vegetarian



Certified  
kosher



Non  
GMO



Natural  
Origin



Water  
Soluble

#### Applications

**OCEAN HEALTH NUTRA™** is a free-flowable powder and it is typically used at 2-5% inclusion to boost nutritional value and for its gelling properties in food and beverages. GRAS Approval & Not Novel status.

#### Packaging & Storage

20kg stitched bags. Store in a dry, cool and clean environment in the original unopened bags.

#### Shelf Life

Best used within 24 months of manufacturing.



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# OCEANIUM®

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# OCEANIUM PET

## Product Information Sheet

- ✓ End-to-end sustainable and traceable
- ✓ Rich in dietary fiber to support healthy digestion
- ✓ High-quality protein source
- ✓ Contains seaweed bioactives to improve gut microbiome
- ✓ Mineral-rich formula – Contains essential minerals like magnesium, potassium, and sodium for overall health



### Product Description

**OCEANIUM® PET** is a unique, multi-complex extract derived from sustainably sourced seaweed (*Saccharina latissima*), offering a wealth of health benefits for pets.

### Typical Analysis

Total dietary fiber	70 %
Protein	13 %
Microbiology	Complies
Residues of fish, molluscs and crustaceans may be present in seaweed before processing	



Certified  
vegan



Certified  
halal



Certified  
vegetarian



Certified  
kosher



Non  
GMO



Natural  
Origin



Water  
Soluble

### Applications

**OCEANIUM® PET** is a free-flowable powder and it is typically used at 2-5% inclusion to boost nutritional value and for its gelling properties in food and beverages. Not novel status in the EU.

### Packaging & Storage

20kg stitched bags. Store in a dry, cool and clean environment in the original unopened bags.

### Shelf Life

Best used within 24 months of manufacturing.



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## OCEANIUM®

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# OCEAN INK®

## Product Information Sheet

- ✓ Fully biodegradable (100%)
- ✓ Replaces harmful solvent-based inks
- ✓ Good oil & oxygen barrier for screen printing
- ✓ Available in black and natural gold colour
- ✓ High-quality and vibrant printing



### Product Description

**OCEANIUM INK®** is a 100% biodegradable ink derived from sustainably farmed seaweed for screen-printing applications.

### Typical Analysis

Total seaweed-based biomass content	50 - 60 % w/w (non-water content )
Non naturally derived content	<10%w/w (non-water content)
Water content	60 - 80% w/w
Residues of fish, molluscs and crustaceans may be present in seaweed processed to make the seaweed-based biomass used in the inks	



Certified  
vegan



Certified  
vegetarian



Natural  
Origin



100%  
Biodegradable

### Applications

**OCEAN INK®** is a fully biodegradable screen-printing ink for packaging, textiles and promotional applications.

### Packaging & Storage

Store refrigerated when received and between uses. Aim to use within one month of opening

### Shelf Life

One month from opening



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## OCEANIUM®

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