

White Chlorella & GoldRella

THE FUTURE OF PLANT-BASED FOOD

White Chlorella & GoldRella : The future of plant-based food



White Chlorella & GoldRella



White Chlorella vs. GoldRella

White Chlorella



- Naturally rich in protein & fiber
- Contains micronutrients for vegan
- Mask-off beany flavor
- Provides neutral taste & flavor
- Lighten the existing color of the food

GoldRella



- Naturally rich in protein & fiber
- Contains micronutrients for vegan
- Mask-off beany flavor
- Provides umami & saltiness
- Gives a natural bright yellow color

[Properties Comparing with Soy and Pea]

Ingredient	Protein Content	Protein Solubility	Heat Stability	Water Holding Capacity	Oil Holding Capacity	Emulsion Capacity
White Chlorella	60%	GOOD	GOOD	GOOD	MODERATE	GOOD
GoldRella	60%	GOOD	GOOD	GOOD	MODERATE	GOOD
Soy	70%	POOR	GOOD	MODERATE	GOOD	MODERATE
Pea	50%	MODERATE	POOR	GOOD	GOOD	GOOD

White Chlorella & GoldRella : Nutrient-dense whole food solutions

- Fortify vitamin B₁₂ (essential nutrient for vegan), vitamin B₁ & folic acid
- Enrich protein, dietary fiber, iron, magnesium, zinc
- Provides a salty flavor with low sodium content

Test Item	Nutrition Analysis			Intake amount to meet RDI			RDI FDA-recommended daily intake for adult men	Daily Value Met on a Vegan Diet ¹⁾
	White Chlorella	GoldRella	Unit	White Chlorella	GoldRella	Unit		
Protein	62.3	65.6	g/100g	89.9	85.4	g	56.0 g	70-100%
Dietary fiber	14.6	23.4	g/100g	260.3	162.4	g	38.0 g	≥100%
Sodium	9.5	5.8	mg/100g	24210.5	39655.2	g	2300.0 mg	≥100%
Iron	4.6	7.7	mg/100g	175.1	104.0	g	8.0 mg	50-70%
Calcium	20.6	14.7	mg/100g	4854.4	6802.7	g	1000.0 mg	50-70%
potassium	632.0	903.0	mg/100g	743.7	520.5	g	4700.0 mg	≥100%
Magnesium	439.0	318.0	mg/100g	95.7	132.1	g	420.0 mg	≥100%
Zinc	32.4	26.2	mg/100g	34.0	42.0	g	11.0 mg	50-70%
Vitamin B ₁	11.3	10.0	mg/100g	10.6	12.0	g	1.2 mg	70~100%
Vitamin B ₁₂	66.0	60.0	µg/100g	3.6	4.0	g	2.4 mcg	0% ← Essential for vegan
Folic acid	2500.0	7800.0	µg/100g	16.0	5.1	g	400.0 mcg	≥100%



The above analysis was based on testing one lot each of GoldRella and White Chlorella, so there may be slight variations between production lots.

1) Graham, M., Clark, C., Scherer, A., & Ratner, M. (2023)



White Chlorella & GoldRella : Nutrient-dense whole food solutions

- Enrich all 9 essential amino acids

Test Item	Nutrition Analysis			Intake amount to meet RDI			RDI FDA-recommended daily intake for adult men
	White Chlorella	GoldRella	Unit	White Chlorella	GoldRella	Unit	
Arginine	9.29	7.7	g/100g	0.8	1.0	g	75.0 mg
Cystine	0.6	0.8	g/100g	3.7	2.7	g	22.0 mg
Isoleucine	1.27	1.4	g/100g	5.0	4.6	g	63.0 mg
Leucine	3.06	3.2	g/100g	2.5	2.3	g	75.0 mg
Lysine	2.11	2.2	g/100g	-	-	g	- mg
Methionine	0.71	0.6	g/100g	6.5	7.2	g	46.0 mg
Threonine	1.61	1.9	g/100g	3.9	3.4	g	63.0 mg
Tryptophan	0.58	0.6	g/100g	5.9	5.5	g	34.0 mg
Valine	2.13	2.3	g/100g	3.5	3.3	g	75.0 mg
Alanine	3.33	3.6	g/100g	2.0	1.9	g	68.0 mg
Aspartic acid	2.92	3.2	g/100g	2.4	2.2	g	69.0 mg
Glutamic acid	9.55	12.5	g/100g	0.7	0.5	g	63.0 mg
Glycine	2.03	2.4	g/100g	3.1	2.7	g	63.0 mg
Histidine	0.8	0.9	g/100g	-	-	g	- mg
Phenylalanine	1.42	1.6	g/100g	4.9	4.5	g	70.0 mg
Proline	1.67	2.0	g/100g	4.1	3.5	g	69.0 mg
Serine	1.55	1.8	g/100g	4.5	3.9	g	69.0 mg
Tyrosine	1.09	1.1	g/100g	5.1	5.0	g	56.0 mg



White Chlorella & GoldRella : Vitamin B₁₂ Solution

- Vitamin B₁₂ is the most critical nutrient in vegan diets, as it is found almost exclusively in animal-source foods.

[Foods with animal ingredients]



- Symptoms of Vitamin B₁₂ Deficiency



Fatigue



Headaches



Decreased Vision



Impaired Balance







Memory & Mood



Muscle Weakness

- Vitamin B₁₂ needs met by GoldRella in plant-based foods

Food	Serving Size (Max)	Dosage		Vitamin B ₁₂ Intake (Daily Value %)	
		%	g	White C.	GoldRella
 Plant-based meat	85g	5%	4.25g	118%	106%
 Vegan cheese	85g	10%	8.5g	236%	213%
 Egg alternative	100g	2%	2g	56%	50%
 Cookies	105g	10%	10.5g	292%	263%

→ Nutrients are present even after finished product application
e.g) Vitamin B₁₂ content remains after extrusion

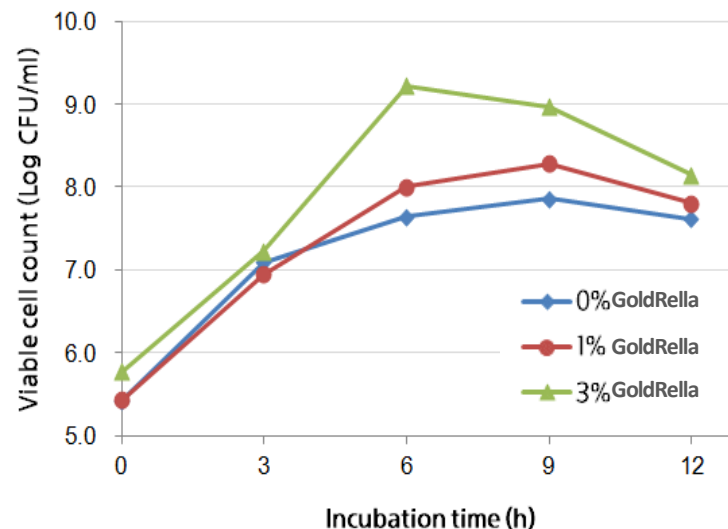
Application : Vegetable Protein Powder

- Balanced, High Nutrition Content

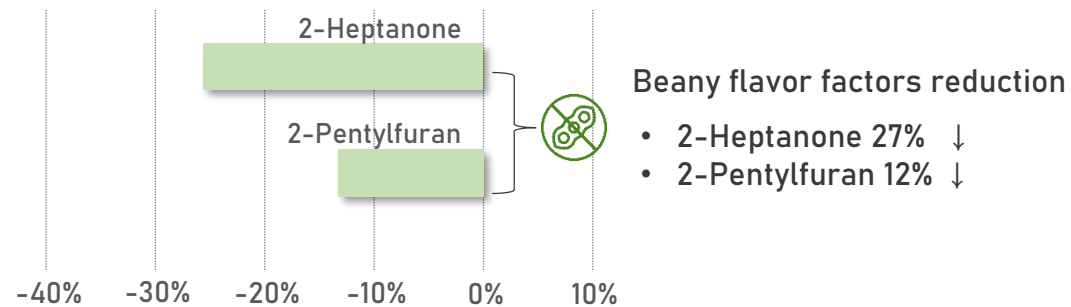


- Recommended Dosage : 20%** of solid material
- **Less or more can be added depending on formulation ingredients and desired protein content

- Probiotics Growth Effect



- Beany note masking effect 



Application : Vegan Cheddar Cheese

• Formulation

Ingredient	Control	GoldRella
GoldRella	-	15.0
Water	45.0	45.0
Coconut Oil	20.0	17.3
Tapioca Maltodextrin	12.0	-
Other Starches	20.1	20.1
Salt	1.8	1.8
Cheddar Cheese Flavor	0.4	0.4
Other Flavors	0.6	0.5
Total	100	100

[5% GoldRella]



[10% GoldRella]

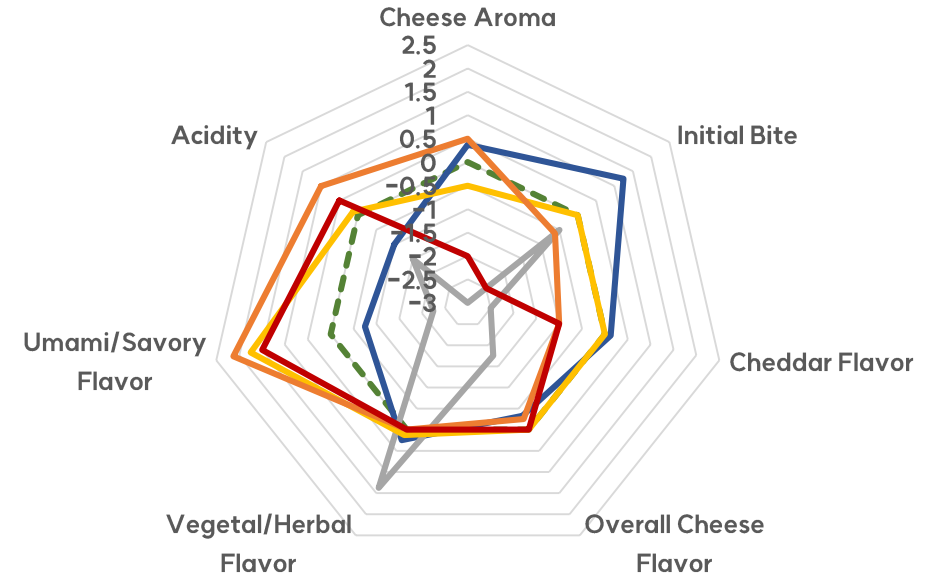
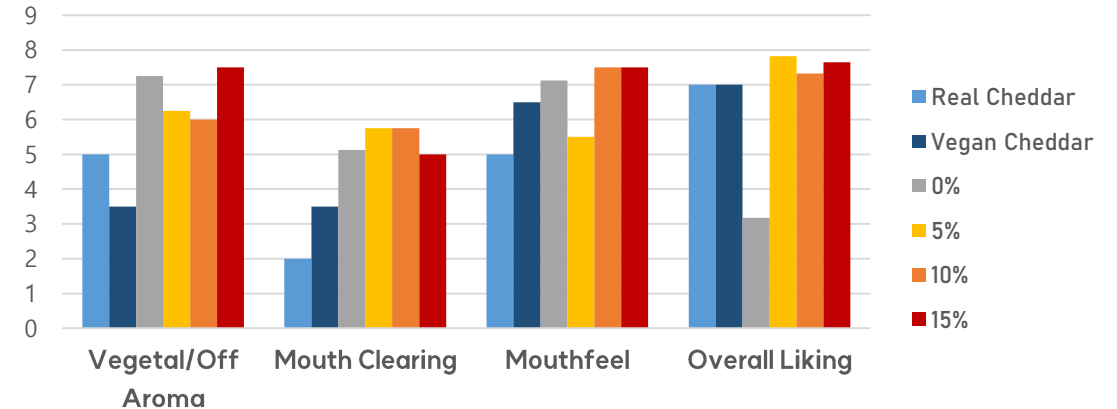


[15% GoldRella]



- ✓ No need for additional colors (e.g. β -carotene) when applying GoldRella cheddar cheese
- ✓ White Chlorella can be applied to white-colored cheeses such as feta, cream cheese with same effect of GoldRella.

• Sensory Evaluation



Application : Vegan Cheddar Cheese

• Nutrition Fact

[Commercial Product Label]

Vegan Cheddar Cheese



[Test Sample Label]

Vegan Cheese w/ 15% GoldRella

Nutrition Facts	
10 servings per container	
Serving size	1 slice (21g)
Amount per serving	
Calories	60
% Daily Value*	
Total Fat 4.5g	6%
Saturated Fat 3g	15%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 150mg	7%
Total Carbohydrate 2g	1%
Dietary Fiber 1g	4%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 3g	
Vitamin D 0mcg	0%
Calcium 1mg	0%
Iron 0mg	0%
Potassium 29mg	0%
Vitamin B₁₂ 1.9mcg	80%

*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

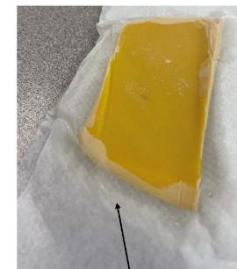
15% GoldRella of the formula provides :

- ⊕ 3g of protein per serving
- ⊕ 4% of the daily value for fiber
- ⊕ 80% of the daily value of vitamin B12
- ⊖ Reduce the amount of saturated fat
(replace 3% of the fat in the formula without losing creamy mouthfeel)

• Storage Stability

Refrigerated & frozen sample (4weeks)

- Lower hardness & drying
- Protects against moisture migration & syneresis
- Retain original flavor & color



▲ Syneresis seen in 15% GoldRella frozen sample

• Melt Test

Aged sample (refrigerated - 4 weeks)

- Higher GoldRella content melts better



▲ Baked in the oven for 5min at 450°F

Application Test : Egg Alternative

• Formulation

Ingredient	Control	GoldRella
GoldRella	-	1.0
Water	83.0	78.1
Soy Protein Isolate	5.3	9.9
Canola Oil	10.0	9.3
Salt	1.0	1.0
Gellan Gum	0.5	0.5
Enzyme	0.1	0.1
Egg Yolk Flavour	0.1	-
Total	100	100

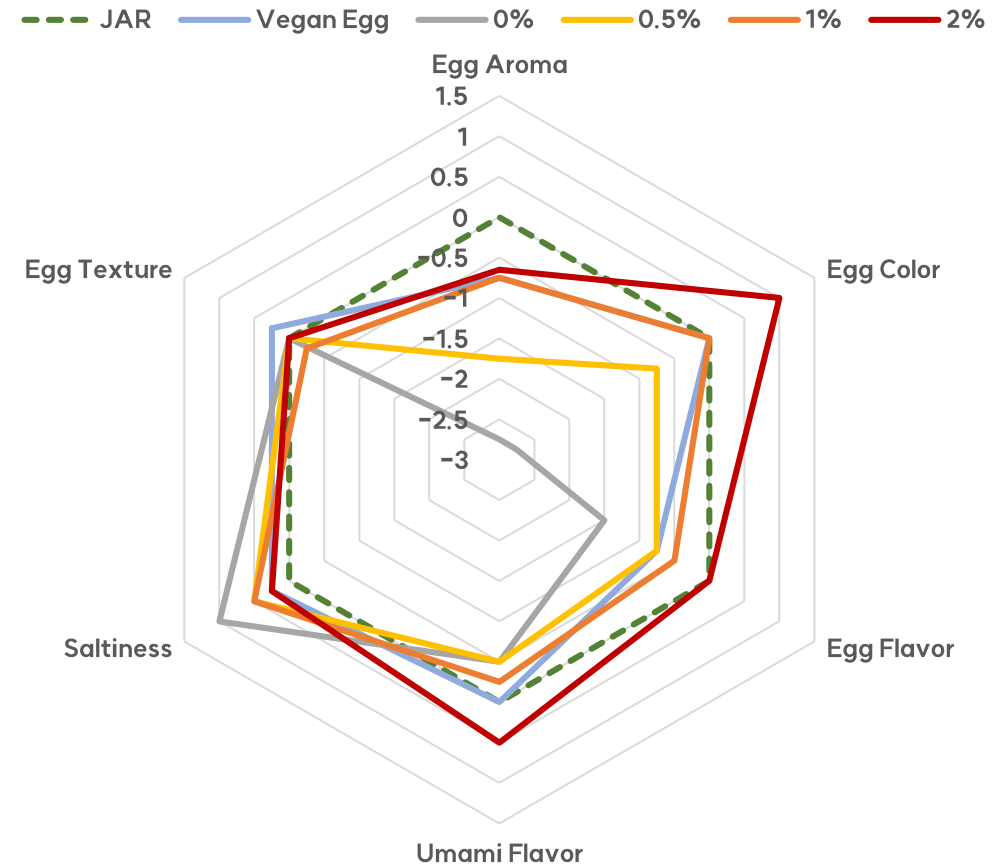
[Control]



[2% GoldRella]

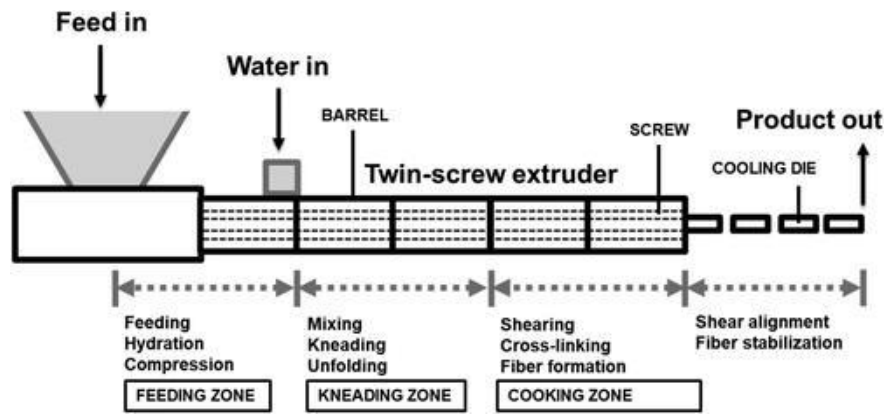


• Sensory Evaluation

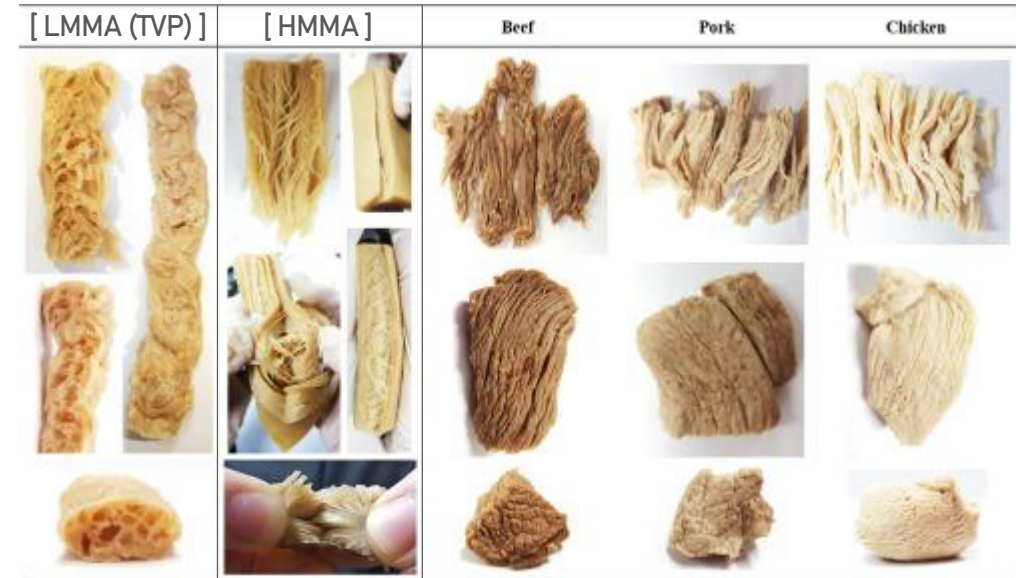


Application Test : Meat Alternatives

• Extrusion



• Final Products



Ref : Woodhead Publishing, 2020, Pages 205-224

Low moisture extrusion



Textured vegetable protein (TVP)

- Moisture content < 35%
- Sponge-like texture
- Rehydration prior to application

High moisture extrusion



High moisture extrudate (HME)

- Moisture content > 40%
- Filamentous, meat-like texture
- No rehydration



[LMMA (TVP)]



[HMMA]



Application Test : Meat Alternatives

- Formulation (HMMA w/ **White Chlorella**)

Ingredient	Control	5%	10%	15% + Gluten
White Chlorella	-	5	10	15
Water	61.5	61.5	57.5	53.5
CSP	37	32	31	25
Oil	1.5	1.5	1.5	1.5
Gluten	-	-	-	5
Total	100	100	100	100

* WCR (White Chlorella) : Lot No. 38003

** CSP (Concentrated Soy Protein) : ADM, Protein content 75%

- Sensory Evaluation



Ingredient	Control	5%	10%	15% + Gluten
Texture	Chewy	Chicken Breast	Chicken Tender	Solid
Flavor	Beany note	- Beany note + umami	- Beany note ++ umami	- Beany note ++ umami
Color	Dark beige	Beige	Light beige	Off white

- Formulation (LMMA(TVP) w/ **GoldRella**)

Ingredient	Control	25%
GoldRella	-	25
Water	27	25
CSP	70	47
Flavor	2	2
Salt	1	1
Total	100	100

- Sensory Evaluation

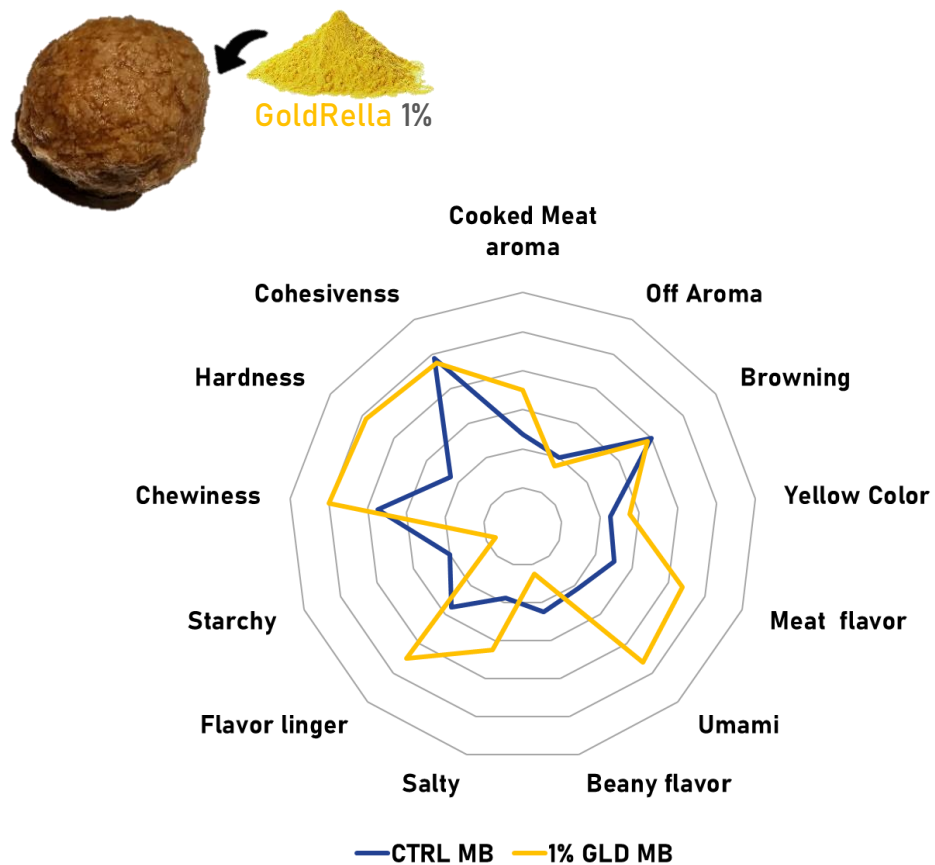


Ingredient	Control	3~25%
Flavor	Beany note	- Beany note + umami
Color	Beige	Yellowish beige

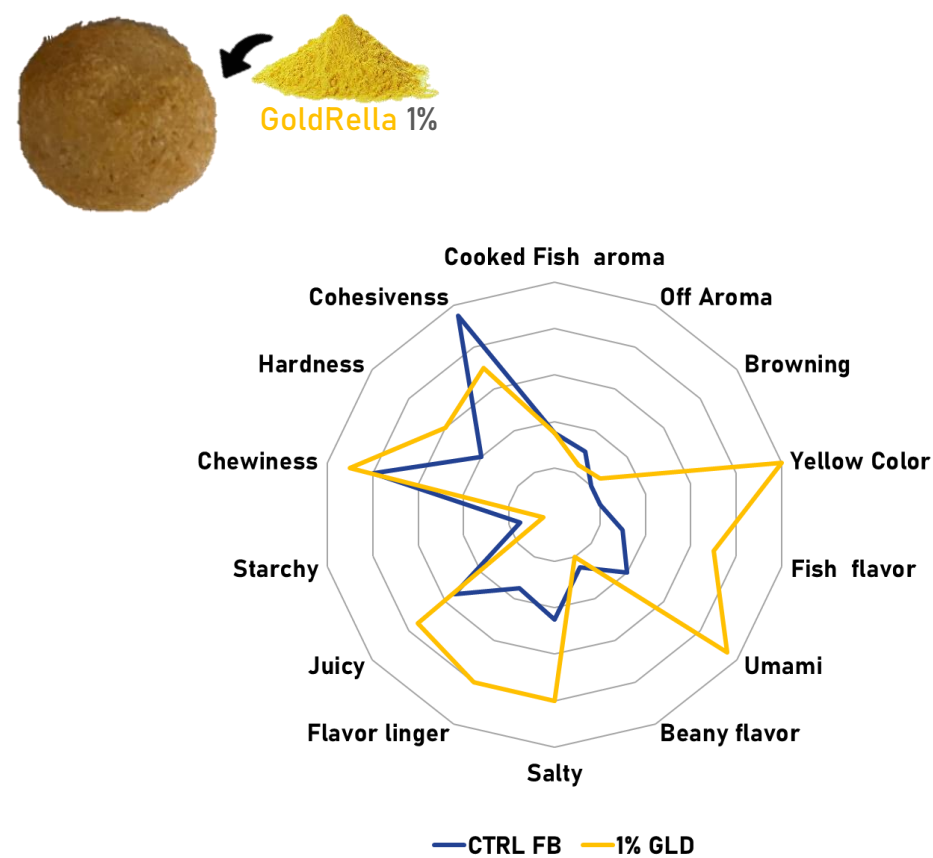
Application Test : Meat Alternatives (Boosting Flavor)

- By adding 1% of GoldRella, sensory elements improved
: masking beany flavor, enhancing original flavor of product, increase saltiness & improving texture

[Pea protein TVP Meatball]



[Soy protein TVP Fish ball]



Application Test : Bakeries

- By adding white Chlorella and GoldRella, sensory elements improved & ease of cookie making increased
 - : Savory taste (saltiness, lingering, umami)
 - : Chewy texture (slows down the cookies crumbling)
 - : Improve dough adhesion
 - : Reduce the spreadability of cookies when baking

[White Chlorella Cookie]



Ingredient	Control	White Chlorella
White Chlorella	-	4
Oil	16	16
Dark Sugar	23	23
Almond Milk	14	14.2
Whole Wheat Flour	46	42
Baking Powder	1	1
Total	100	100

[GoldRella Cookie]



Ingredient	Control	GoldRella
GoldRella	-	4
Oil	16	16
White Sugar	23	23
Almond Milk	14	14.2
Whole Wheat Flour	46	42
Baking Powder	1	1
Total	100	100

Application Test : Bakeries

- Fortified nutrients by GoldRella or White Chlorella remain intact after the high-temperature cooking process

[Nutrition analysis of sponge cake w/ white Chlorella]

- Protein, fiber, vitamin B₁₂ increase when white Chlorella is added.
- When ≥5% WCR is added, Vitamin B₁₂ content meets the daily recommended consumption amount.



[Control]

Nutrition Facts	
Serving size	1piece(100g)
Amount per serving	
Calories	306
Carbohydrate 52g	16%
Fat 8g	14%
Protein 8g	15%
Fiber 3g	12%
Vitamin B ₁₂ 1.1mcg	46%



[White Chlorella 3%]

Nutrition Facts	
Serving size	1piece(100g)
Amount per serving	
Calories	313
Carbohydrate 51g	16%
Fat 8g	15%
Protein 10g	18%
Fiber 3g	12%
Vitamin B ₁₂ 2.1mcg	85%



[White Chlorella 5%]

Nutrition Facts	
Serving size	1piece(100g)
Amount per serving	
Calories	314
Carbohydrate 50g	15%
Fat 8g	16%
Protein 11g	21%
Fiber 3g	13%
Vitamin B ₁₂ 2.7mcg	114%








[White Chlorella 10%]

Nutrition Facts	
Serving size	1piece(100g)
Amount per serving	
Calories	306
Carbohydrate 47g	14%
Fat 8g	15%
Protein 14g	25%
Fiber 5g	20%
Vitamin B ₁₂ 4.0mcg	168%

Application Test : General Foods

- By adding 1% of white Chlorella or GoldRella, sensory elements improved
: masking beany flavor, enhancing original flavor of product, increase saltiness & improving texture

Application	Nutrition bar	Cheese cracker (non-vegan)	Vegan chicken soup	Noodle	Sponge cake
Prototype					
GoldRella Dosage	min 10~ max 30%	min 5~ max 12%	min 1~ max 20%	2%	~ max 10%
Key Features	<ul style="list-style-type: none"> • A sweet/savory peanut butter last • A roasted chestnut aftertaste • Can be labeled as “good source of protein” 	<ul style="list-style-type: none"> • Performance as MSG alternative • Bright orange-yellow color (expected for a cheese cracker) • Strong umami (matching well with cheese flavor) 	<ul style="list-style-type: none"> • Performance as MSG alternative • Extra richness & mouthfeel • Umami • Less Sodium 	<ul style="list-style-type: none"> • Performance as MSG alternative • Extra richness & mouthfeel • Umami • Less Sodium 	<ul style="list-style-type: none"> • Umami • Density increases • Hardness & chewiness increase

Launched Products

- Nutrition fortified food

[Healthy Drink]



[Protein Drink]



- Weight management food

[Soy Noodle]



- Medical food

[Fried Rice for Diabetes]



GoldRella 0.84%

- General food

[Corn Dog & Croquette]





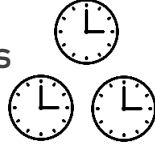
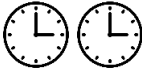


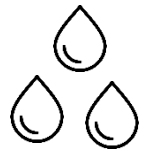









[Porridge]



Sustainability

- Sustainability compared to beef, legume & wheat

	Beef 	Legume 	Wheat 	White Chlorella & GoldRella 
Time For harvesting protein	1.5 years 	2-3 months 	4 months 	6 days 
Water Consumption Per 1g protein	112L 	19L 	3-26L 	0.3L 
Land Use Per 1,000kcal	119m ² 	2-3m ² 	1.44m ² 	0.07m ² 

Source : Daesang



Production of White Chlorella & GoldRella

- Strain : *Chlorella protothecoides*
- Daesang's Chlorella is grown in a 100% closed system, without disturbing nature.
- GMO-free breeding techniques to develop microalgae (random mutagenizes natural selection method)

[Heterotrophic cultivation (closed cultivation system)]



Advantage

- Higher sustainable biomass
- Controlled culture environment
- Higher productivity
- Free from contamination

Disadvantage

- High construction and operation cost

[Photoautotrophic cultivation (open cultivation system)]



Advantage

- Low construction and operation cost

Disadvantage


- Inconsistent quality due to external environment
- Settling causes low yield
- Unstable algal populations
- Difficulty in nutrients distribution
- Difficult to avoid contamination

Production Information

• Specification



120, Changgyeonggung-ro, Jongno-gu, 03130, Seoul, South Korea
www.daesang.com



SPECIFICATION

January 02, 2023

PRODUCT	GoldRella	
MANUFACTURER	DAESANG Corporation	

TEST ITEM	SPECIFICATION	TEST METHOD
Description	Yellow powder, characteristic odor and taste.	Physicochemical
Crude protein	NLT 55.0 %	Kjeldahl Method
Loss on drying	NMT 5.0 %	FCC/USP<731>
Foreign matters	Not Detected	Visual
Heavy metals (as Pb)	NMT 10 ppm	USP<231>
Arsenic (As)	NMT 1 ppm	USP<232>
Lead (Pb)	NMT 1 ppm	USP<232>
Cadmium (Cd)	NMT 1 ppm	USP<232>
Mercury (Hg)	NMT 0.5 ppm	USP<232>
Total aerobic plate count	NMT 1,000 cfu/g	USP<2021>
Yeast and mold	NMT 100 cfu/g	USP<2021>
Coliforms	Negative	FDA-BAM
E.Coli	Negative	USP<2022>
Salmonella	Negative	USP<2022>

- Shelf life is 3 years at ambient room temperature when properly stored in original package
- Valid period : January 2, 2023 ~ December 31, 2023

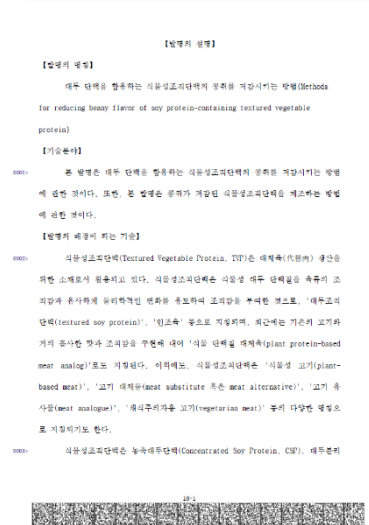
• Packaging



PRODUCT NAME	: GoldRella
NET WEIGHT	: 10 kg
PRODUCTION DATE	: Apr. 22, 2022
PRODUCTION DATE	: Apr. 22, 2022
LOT NO.	: SCA24001
STORAGE	: Store in a cool Dry and Dark place
COUNTRY OF ORIGIN	: South Korea
MANUFACTURER	: Daesang Corp.

• Patent (pending)

: beany flavor masking effect



• Certification

