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# Development of cosmetic products with aubergine peel extracts

**Summer Camp | July 7 – 11, 2025 | Marseille, France**



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# Agri-food Waste Management for Sustainable bio-economy through Higher Education curricula and upskilling

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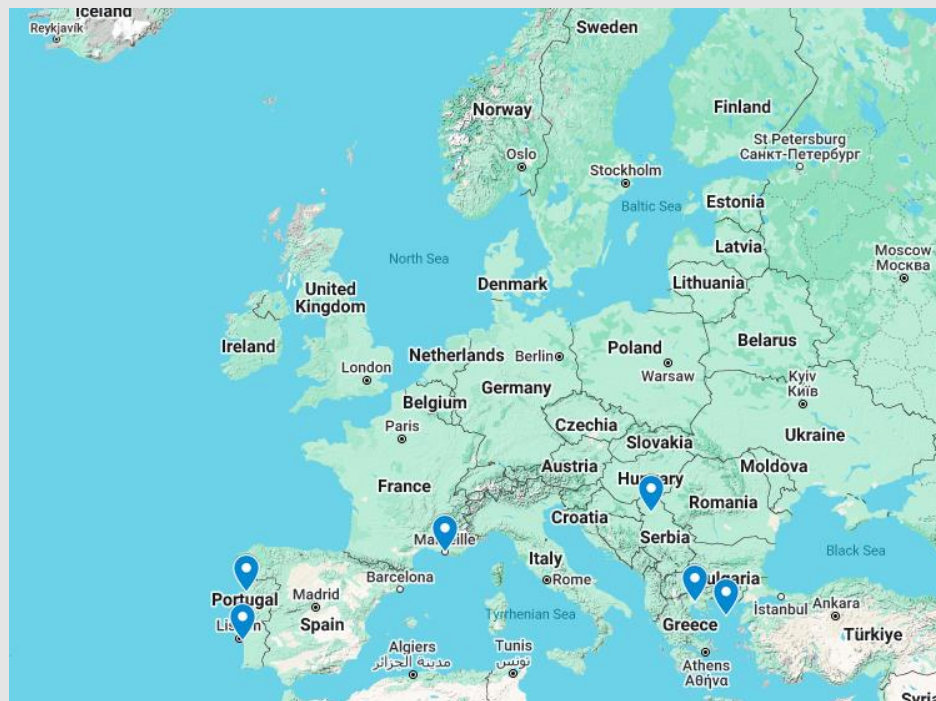
# Goals

**AGRIMA** aims to foster universities' **capacity building** for the **green transition** through innovative practices and higher education curricula updating in agri-food waste management for the **circular bioeconomy**.

**AGRIMA** addresses:

1. **Advancing pedagogical methods** for industrial agri-food waste valorisation **based on business-academia synergies**.
2. **Integrating citizen science** in bio-economy-enhanced waste valorisation as a means of **civic engagement and environmental advocacy**.





# Partners



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# CONCERNING STATISTICS ABOUT FOOD WASTE

- According to [Eurostat](#) [1], the EU generated:

**59.2 million tonnes** of food waste, or **132 kg of food waste per person**

Food waste costs EU **€143 billion** annually

Food waste contributes to **8–10% of global greenhouse gas emissions**

Squanders **28% of the world's agricultural land**, and consumes **25% of agriculture's freshwater**

**Globally, the annual food waste exceeded 1 billion tonnes in 2022.**

# Food waste in the EU by main economic sectors, 2022

(kg per inhabitant)

Primary production

10 KG

Retail and other distribution of food

11 KG

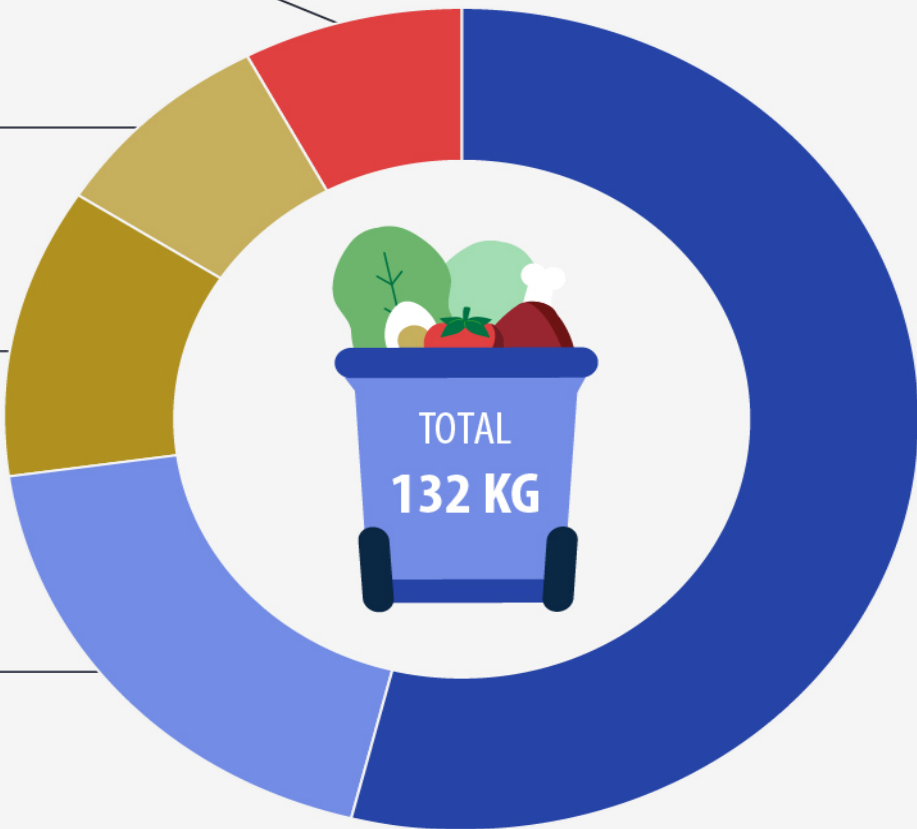
Restaurants and food services

15 KG

Manufacture of food products and beverages

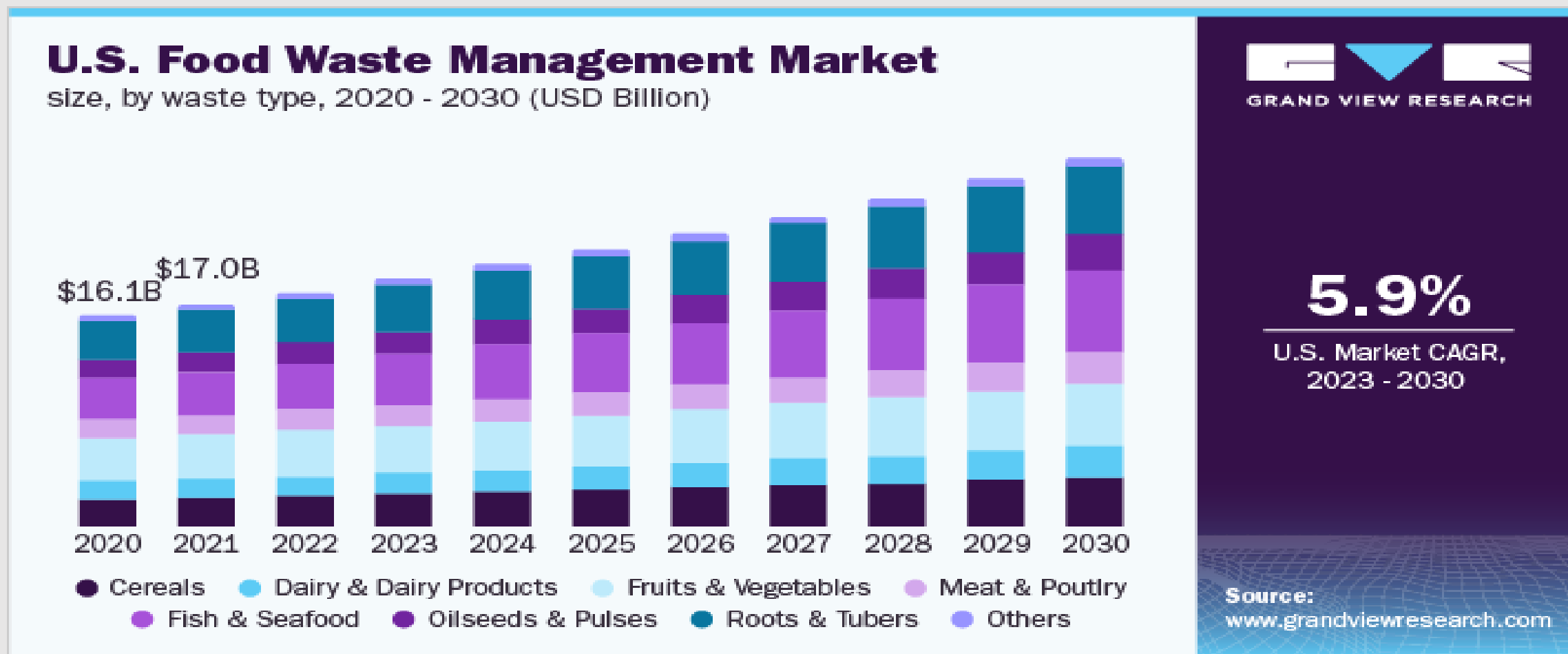
25 KG

Households  
72 KG



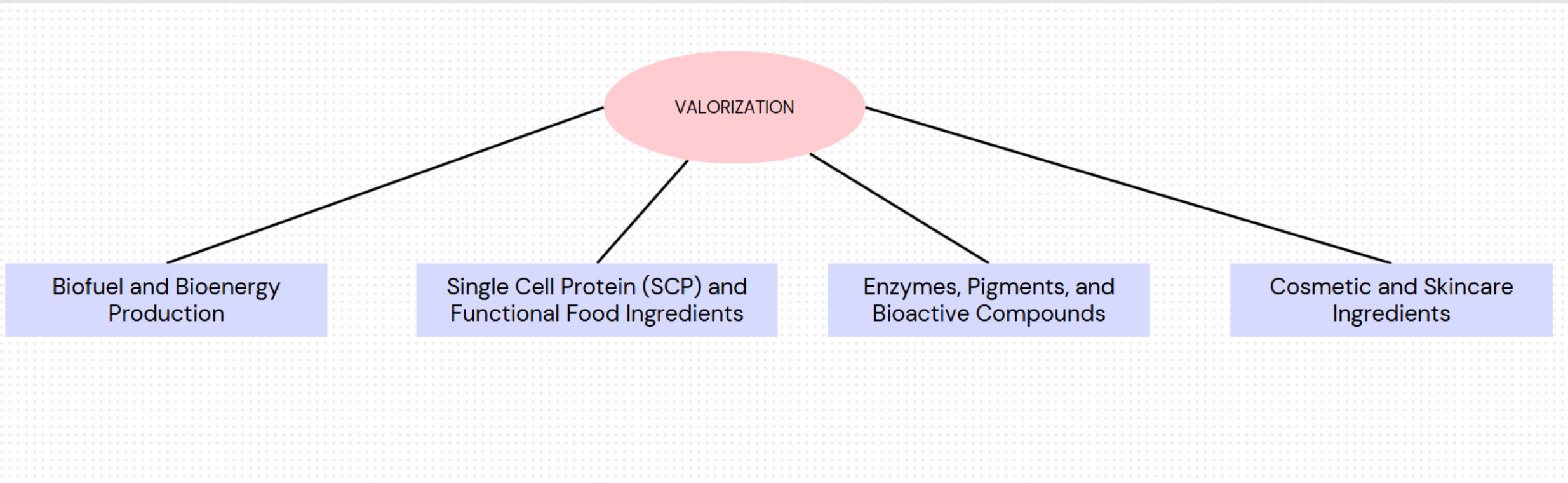
Data not available for Greece, Spain, Lithuania and Romania.  
EU aggregate: estimated.

According to the [Future Market Insights](#) [2], the market for products made from food waste was estimated at **USD 60.8 billion in 2025**, and is expected to grow to **USD 99.0 billion by 2035**, with a **CAGR of 5.0%**.



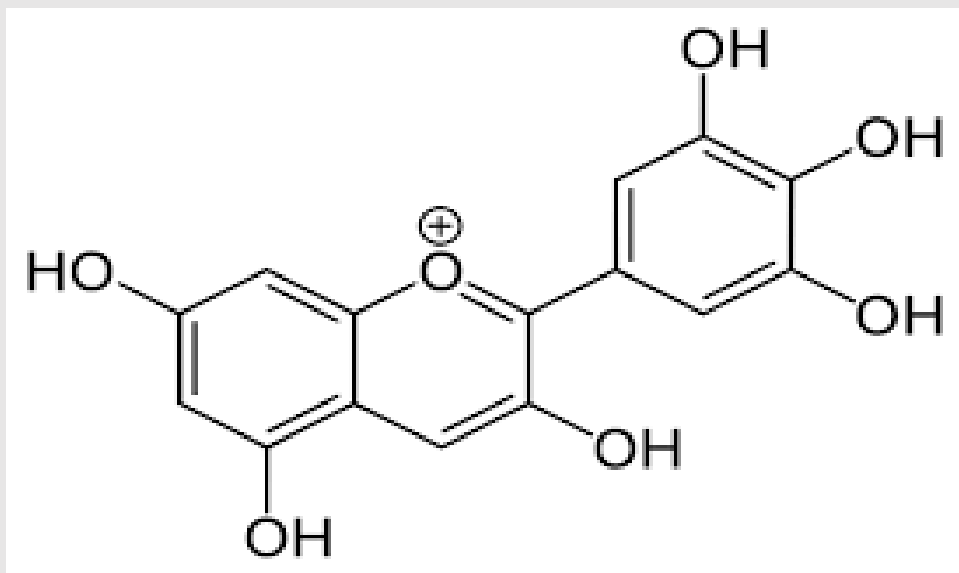
# WHAT IS VALORIZATION ACTUALLY?

- Valorization refers to the process of converting food waste into higher-value products

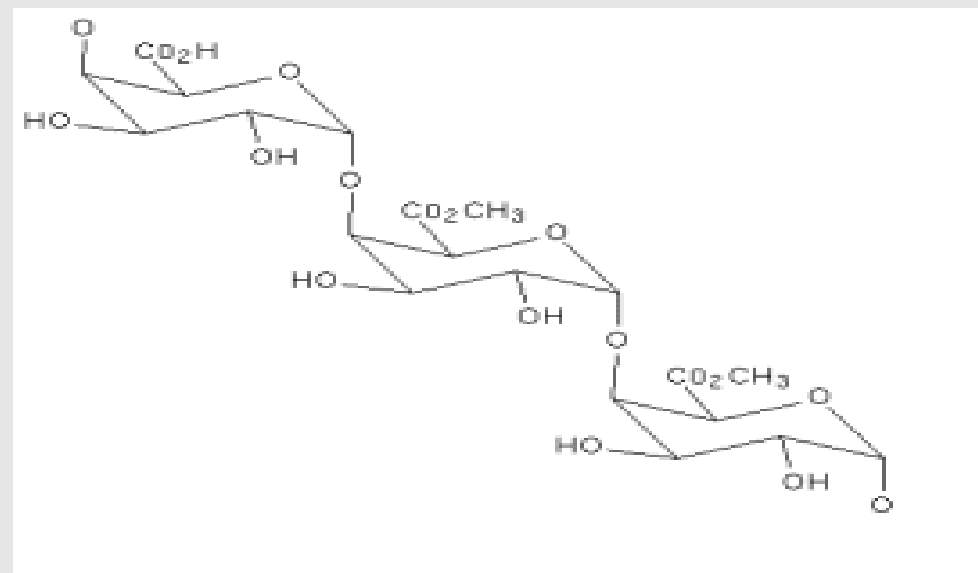


# ABOUT THE STARTING MATERIAL

- Over ten million tonnes of eggplant by-products are generated annually.
- The peel is an outstanding source of **anthocyanins**, **dietary fibers**, such as **pectin** and **cellulose**
- EP is one of the highest yielding agricultural by-products regarding the extraction of **pectin**
- **Flavonoids** (in peel) & **Phenolic acids** (in flesh) [3,4].



Delphinidin



Pectin

- **Most used methods** for extracting and valorizing compounds from eggplant (Aubergine) by-products, especially the peel:

1. Solvent Extraction
2. Ultrasound-Assisted Extraction (UAE)
3. Microwave-Assisted Extraction (MAE)
4. Enzyme-Assisted Extraction (EAE)
5. Integrated Biorefinery Approach [3]



In this research **subcritical water extraction** was the chosen method of extracting the aubergine peel.

- **Pioneering project**

# Subcritical water extraction

- environmentally friendly method
- water at high temperature (100–374°C) and high pressure (to keep it in liquid form) to extract bioactive compounds from plant materials.

## **Key benefits of this technique:**

1. No toxic solvents needed — just water.
2. Efficient extraction of both polar and nonpolar compounds.
3. Ideal for extracting heat-stable bioactives.
4. Sustainable and green technology. [5]



# A Research Plan / Methodology for Developing Cosmetic Products from Eggplant Peel Extract:

1. Extraction process (subcritical water extraction of dried, ground eggplant peel)
2. **Quantitative** analysis of bioactive compounds:
  - Total phenolics
  - Total flavonoids
  - Anthocyanins
  - Antioxidant activity (total and radical scavenging against DPPH and ABTS)
  - Pectin content
  - Reducing sugars content (indicating partial cellulose/hemicellulose hydrolysis)
3. **Qualitative phytochemical screening**
4. **Application of the extract in cosmetic formulations:**
  - Face cream
  - Aftershave lotion (specifically for men)

# Extraction process (subcritical water extraction of dried, ground eggplant peel)

- Sample preparation
- Drug-to-solvent ratio = 1:30
- Nitrogen pressure: 40 bar
- Temperature: 130°C
- Time: 30 minutes
- Agitation speed: 500 rpm (convection)



# Results of Eggplant Peel Extract

| Parameter                              | Result (mg/100 g dry sample) |
|----------------------------------------|------------------------------|
| Total phenolic content (GAE)           | 1050.01 ± 5.95               |
| Total flavonoid content (RE)           | 390.99 ± 10.03               |
| Total anthocyanin content (C-3-G)      | 30.19                        |
| Total antioxidant activity (AAE)       | 2673.19 ± 53.25              |
| DPPH radical scavenging activity (AAE) | 1531.61 ± 12.66              |
| Total reducing sugars (GE)             | 17.92 ± 0.06                 |



## 1. High in bioactive compounds

Total phenolics: 1050 mg/100 g



Flavonoids: 390.99 mg/100 g



2. **Moderate anthocyanin content**  
**30.19 mg/100 g**

(likely sensitive to extraction temperature)

3. **Strong antioxidant activity**  
Confirmed via **DPPH** and **ABTS** assays  
**ABTS IC<sub>50</sub> = 7.69 mg/mL**





**4. Pectin: 3.99%** → improves moisturization & texture

Low reducing sugars → indicates good process control

**5. Anti-inflammatory, astringent, and regenerative potential**

**6. Suitable for anti-aging creams and aftershave products**

# 7. Phytochemical profile supports application

Presence of flavonoids, tannins, alkaloids, coumarins, O-/C-heterosides

| Class of Chemical Compounds  | Presence in Sample |
|------------------------------|--------------------|
| Free flavonoids              | +                  |
| Anthocyanins                 | –                  |
| Total tannins                | ++                 |
| Gallic tannins               | +                  |
| Reducing sugars              | –                  |
| Glycosides                   | –                  |
| Alkaloids                    | +                  |
| Coumarins                    | +                  |
| Saponosides                  | –                  |
| O-glycosides (O-heterosides) | +                  |
| C-glycosides (C-heterosides) | ++                 |





*“The daily cream based on eggplant peel extract has a **fast absorption rate after application**. One of its advantages is that it **doesn’t clog pores** and doesn’t feel heavy—it has a **light texture**. It provides a **high level of hydration**, leaving the skin elastic and soft to the touch. It has an intense and **pleasant scent**, a light purple—more precisely, light lilac—color, and a **creamy texture**”.*

*“This aftershave enriched with eggplant peel extract, offers a **refreshing and soothing experience immediately after shaving**. Its **lightweight, non-greasy formula absorbs quickly into the skin without clogging pores**, making it ideal for daily use—even on sensitive skin.*

*The high antioxidant content helps calm irritation and **reduce redness, while providing a gentle layer of hydration** that leaves the skin feeling smooth, balanced, and nourished. The scent is clean and subtly earthy with a hint of floral notes, offering a unique and pleasant finish. “*



# REFERENCES

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