Utilization of grape pomace for the production of microbial protein- A review

Sotiropoulou E.I.[1*], Liouni M.[1], Calokerinos A.C.,[2] Nerantzis E.T [3],

[1]Laboratory of Industrial Chemistry, Dept. of Chemistry, National & Kapodistrian University of Athens, Greece
[2] Laboratory of Analytical Chemistry, Dept. of Chemisty, National & Kapodistrian University of Athens, Greece
[3]Laboratory of Biotechnology & Industrial Fermentation, Dept. of Enology, TEI of Athens, Greece

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Introduction

- During the red and the white vinification, a large number of by products is produced
- In Greece, it is estimated that the annual production is about **525,000 tons of grapes** which leads to **142,000 tons of winery waste**
- **100 kg fresh marc** are constituted from **30 kg** of fresh **pulp**, **25 kg of fresh seeds** and **20 kg stalks**

- Recent studies showed that winery by-products may negatively affect the environment by presenting toxicity to crops and wetlands
- Researches focused on wastewater of wineries were considered to be responsible for the contamination of groundwater resources

Sustainability in the wineries

Encourage wineries to apply value adding technologies in order to:

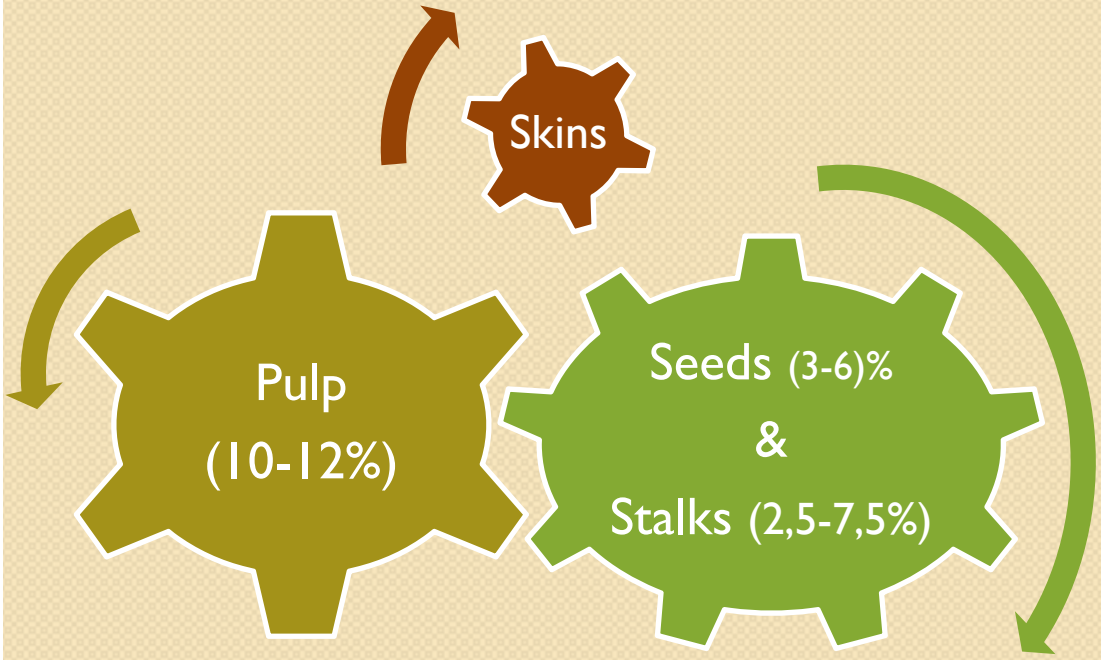
- **Reduce** their waste generation and disposal
- **Provide** further alternatives to diminish the environmental impact of the winery activity
- **Introduce** additional sources of income

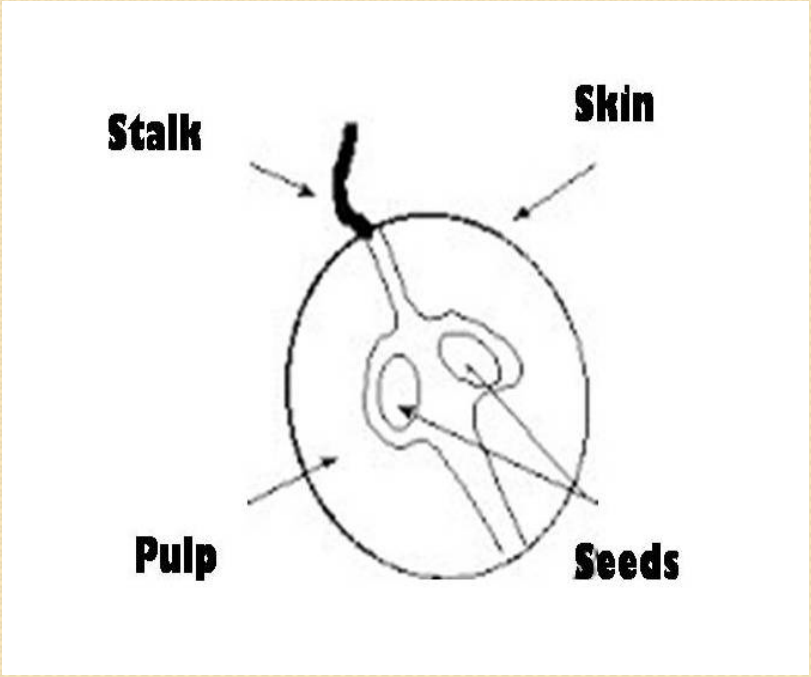
Grape skin & grape seed

- They are the main by-products
- Used: ⇒ produce another product (grape seed oil)
  ⇒ compost for the production of alcohol
  ⇒ create a new type of human food
  (grape seed powder)

Grape pomace -Definition

- The solid remains of pressed grapes
- It is equivalent to about 20% of the grapes used
- Result after pressing grapes for juice or oil
- It contains:





Conventional applications

Animal Feeding

Fertilizer

More applications

- **Pulp** can be composted after mixing with other minerals and used as **fertilizer**
- Grape pomace: **fermented** with special crops and produce **high added value and purity substances such as polysaccharide or produce alcohol**
- Using grape pomace with the composting process; **substrate for plants** & substrate for **cultivation of mushrooms**
- Fermentation with different microorganisms & different treatment (hydrolysis or not) ➡ the extraction of tannins & polyphenols

Microbial protein Definition

- It refers to dead, dry cells of micro-organisms such as yeast, bacteria, fungi and algae which grow on different carbon sources.
- The name "**single cell protein**" was used to give a better image than "microbial protein.

Microbial protein: advantages & usages

- The utilization of grape by-products in the production of microbial protein will help in controlling pollution
- Help solving waste disposable problem to some extent
- Satisfy the world shortage of protein rich food
- SCP has high protein content (about 60-82% of dry cell weight), fats, carbohydrates, nucleic acids, vitamins and minerals.
- It is rich in certain essential amino acids like lysine, methionine which are limiting in most plant and animal foods
- It can be used as additive to the main diet instead of sources known very expensive (soya bean and fish)
- Grape pomace waste with good nutrient content can be converted into food enriched with protein and feed and by properly utilizing them, will bring an end to the protein deficiency around the world
- Furthermore, good nutritious food can be supplied with least expenditure of cost.

Where microbial protein is used?

- **Animal nutrition**

fattening calves, poultry, pigs and fish breading

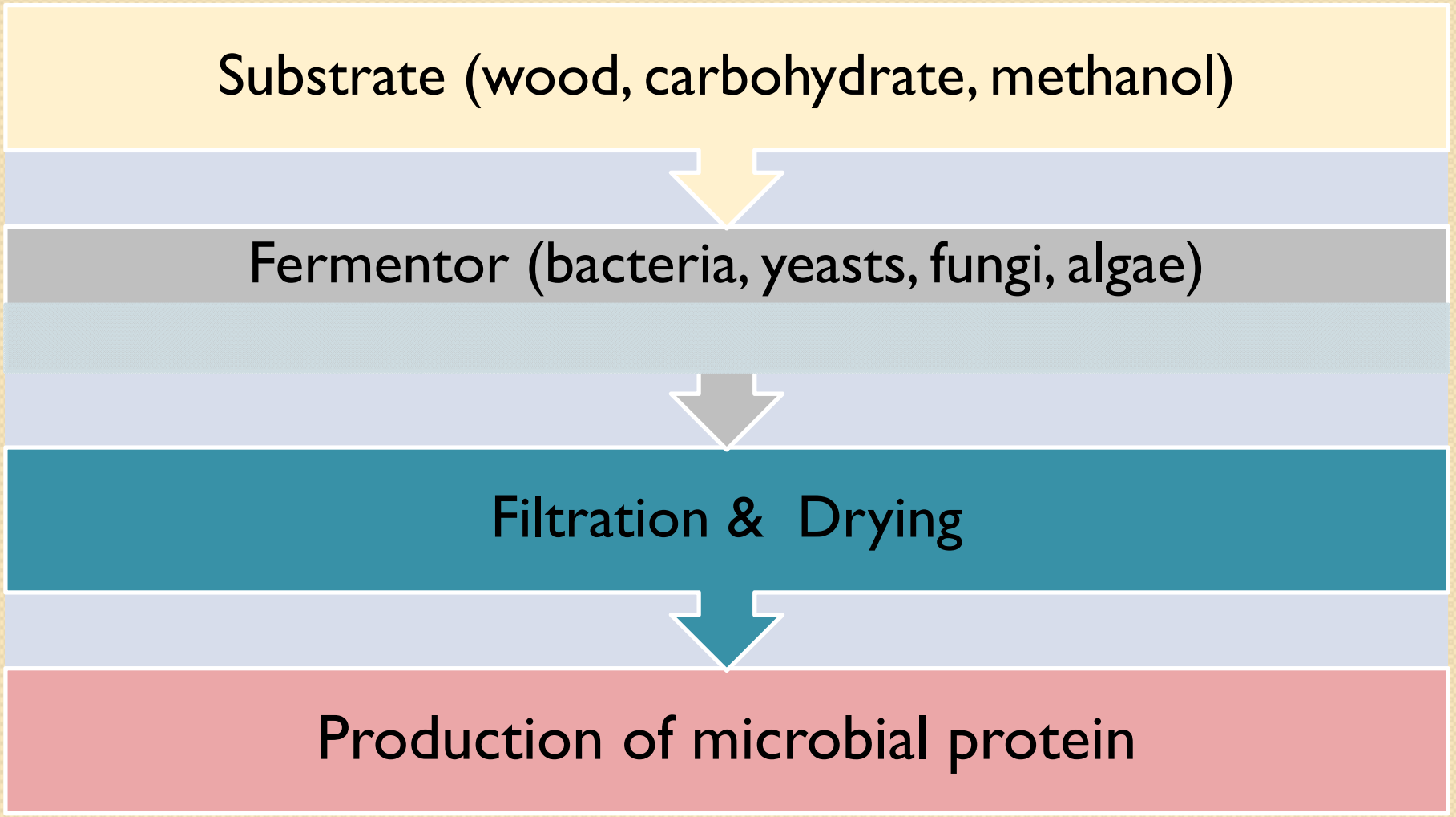
- **Foodstuffs area**

aroma carriers, vitamin carrier, emulsifying aids and to improve the nutritive value of baked products, in soups, in ready-to-serve meals, in diet recipes

- **Technical field**

paper processing, leather processing and as foam stabilizers

Production process of microbial protein



Fermentation process (I)

- Grape and wine by-products are a good source of carbon and have been used to generate various high-value products
- Major components of grape biomass waste are cellulose pectins and lignins (including tannins)
- Fungi belonging to the division Ascomycota, such as Trichoderma spp., Aspergillus spp. , Penicillium spp., are known for their biomass degrading ability and should prove useful in grape biomass degradation
- Protein rich products can be used as feedstock for animals.
- The protein content of grape marc has been managed to be increased from 7% to up to 27% in five days using solid state fermentation process, certain fungal strains and specific conditions like temperature and moisture content

Fermentation process (II)

- *Pleurotus ostreatus* is the third most important edible mushroom cultivated worldwide
- It can easily decompose lignocellulose without chemical or biological pretreatment as it possesses an enzymatic complex system that includes phenol oxidases and peroxidases
- Therefore, they can be utilized and recycled by solid state fermentation (SSF) using various strains of mushroom
- The bioconversion of vineyard prunings and grape pomace by Pleurotus spp. with SSF was evaluated by measuring the fruiting body as alternative attempt for recycling of winery agroindustrial wastes

Ongoing research work

- A series of experiments are planned to be performed to obtain an optimized protocol for degrading winery biomass waste.
- Both submerged fermentation and SSF processes will be assessed using the fungi ***Pleurotus ostreatus*** .
- The fermentation process will be held in a solid state fermentation **bioreactor,** designed specifically for the needs of this research where conditions like temperature and pH were measured on a regular basis.
- Various analyses (temperature, pH, ash, total nitrogen) will be performed on both, the substrate and the fermented product.

Conclusion

- Introduction of grape pomace as a new vehicle to produce microbial protein
- The present study aims to prove that grape pomace have compounds with beneficial effects when correctly used as a substrate allowing the valorization of winery by- products and produce value-added products.

Thank you for your attention!

Contact info:
Evangelia Sotiropoulou, evasot@chem.uoa.gr
Oenologist, MSc, PhD Cand.