Re-use and valorisation of orange peel waste from school canteen for essential oil production - a case study at Lusófona University

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I – Introduction

According to the European Environment Agency, the large amount of food waste is a serious problem in the European Union. More than 89 million tonnes of waste is produced every year in Europe without any kind of recovery or recycling, causing serious environmental pollution problems. In Portugal oranges are the second most important species in fresh fruit production, accounting for 24% of the total volume of citrus fruit, with a contribution of 355,000 tonnes/year (FAO, 2021). Portugal is therefore a large producer and consumer of oranges, resulting in large quantities of orange peel waste. This problem is particularly acute in school canteens, restaurants and other shops specialised in fresh fruits and drinks, where large quantities of orange waste are generated, without any reuse or recycling. At this conference, the FE's Eco-School project team intends to share with the community an innovative example of the circular bioeconomy in terms of the valorisation of organic waste, namely the transformation of orange peel from campus canteens to produce essential oil.

II – Aim

This work aims to demonstrate that it is possible to recycle this organic waste and transform it into a raw material for use in the production of orange essential oil, with high commercial value that can be incorporated into cosmetic and perfumery products such as perfumed water or other high value-added products.

III – Material and Methods

A pilot study was carried out at Lusófona University, involving students, teachers, and the whole school community, during the months of January, February, April, and May. The waste samples were collected 3 times a week. The students involved in this project collected and quantified orange waste from the canteens and proceeded to the extraction by hydro distillation, obtaining orange oil that has been used in the development of a new cosmetic and fragrance formulation.

- Experimental Process (Figure 1)

a) Wash the orange waste with running water to remove contaminants

b) Remove the surface of the orange with a grater.

c) Perform hydro distillation at a ratio of 1:3 (w/v) for 4 hours at boiling temperature.

d) Decantation of the two phases (essential oil/water).

e) Extraction of orange essential oil and hydrolate.

f) Formulation of the final product.

g) Compost the waste.

h,i) Use of the compost in the organic garden.

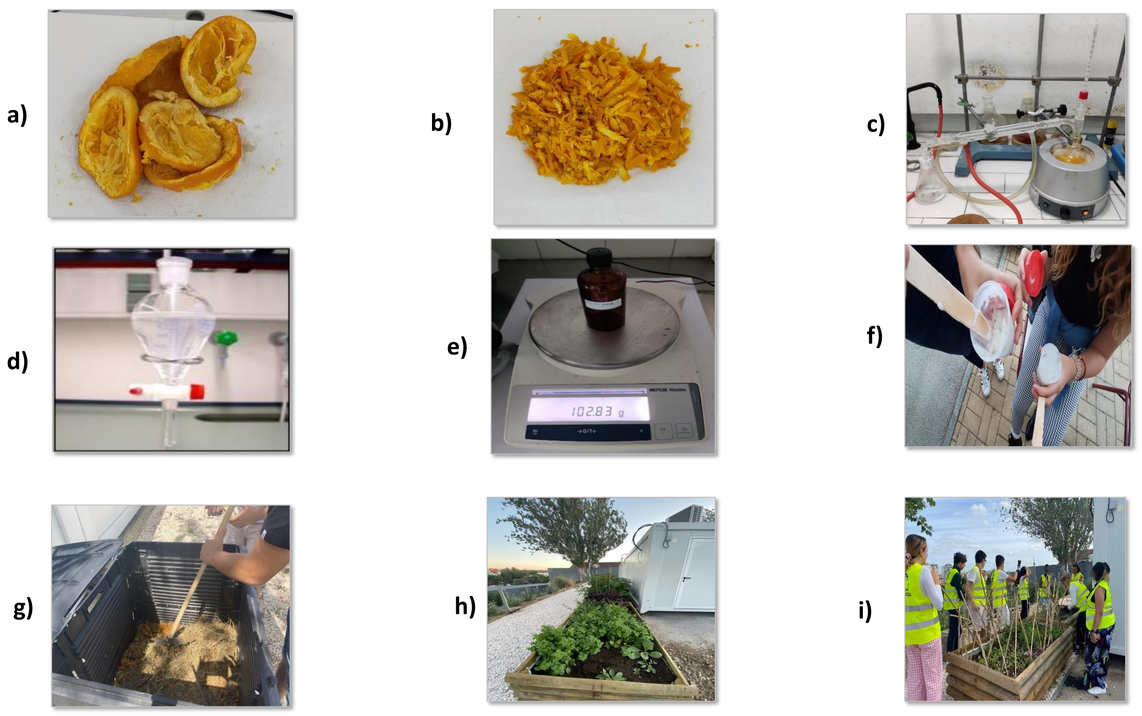

Figure 1 - The main stages of the experimental procedure for the extraction of essential oils and waste valorization.

IV – Discussion and Results

Using the two products obtained from the extraction, it was possible to carry out various activities on cosmetic production. Different end products were formulated, such as a flavoured alcohol gel, body emulsions, and refreshing perfumed waters, which were then distributed free of charge to the participating academic community (Figure 2).

Figure 2 - Academic community activities

V -Conclusions

- The study identified a high-yield product that generates 1.95 grams of essential oil per kilogram of orange peel waste.
- Approximately 9600 kg of orange peel waste is generated annually on the Lusófona Campus.
- It was concluded that it would be possible to obtain 18.72 kg of essential oil with a high commercial value.
- The remaining waste left over from the extraction, can be used for composting, and will be used in the Campus gardens.
- This work demonstrates the importance of the Circular Economy, even on a smaller scale and in academic establishments.

VI - Bibliographic references

FAO 2021. Citrus Fruit Statistical Compendium 2020. Rome.