Exploring Bioactive Compounds in Lettuce Wastes and Losses

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Introduction

Population growth and the increasing demand for balanced diets represent a challenge for agriculture in providing sustainable and nutritious foods. The intensification of agriculture generates significant waste and losses (WL) [1,2]. Lettuce (*Lactuca sativa* L.), a commonly consumed vegetable, suffers notable losses due to management practices and adverse transport and storage conditions [3]. This work aims to determine phenolic compounds and antioxidante activity in WL of different varieties of *L. sativa*, to valorize and repurpose these matrices.

Methodology

Lactuca sativa L. 'Curly-leafed'

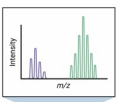
Lactuca sativa L. 'Iceberg'

Lactuca sativa L. 'Little Gems'

Lactuca sativa L. 'Romaine'

Lactuca sativa L. 'Frisée'

Lactuca sativa L. 'Lollo Rossa'



Phenolic compounds

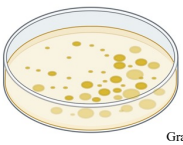
HPLC-DAD-ESI/MS^n

Antioxidant activity

DPPH (free radical scavenging effect);

Reducing Power;

TBARS (inhibition of lipid peroxidation).



Anti-bacterial activity

Gram-negative bacteria: *Enterobacter Cloacae, Escherichia coli, Pseudomonas aeruginosa, Salmonella enterica e Yersinia enterocolitica*

Gram-positive bacteria: *Bacillus cereus, Listeria monocytogenes e Staphylococcus aureus*

Results

In both extracts tested, lollo rossa variety contained the highest levels of phenolic compounds, with hydroethanolic showing the greatest concentrations (29.77 mg/g extract). Quercetin malonyl hexoside was the main phenolic compound (15.3 mg/g extract), while anthocyanins totaled 1.20 mg/g extract, with cyanidin-*O*-hexoside (0.497 mg/g extract) and cyanidin-3-*O*-(6"- malonyl)glucoside (0.706 mg/g extract) predominating. In addition, the decoction extract of this variety showed the best results in terms of antioxidant activity (**figure 1**) in the following assays: TBARS (0.08 mg/mL), DPPH (0.104 mg/mL), and Reducing Power (0.2 mg/mL). Hydroethanolic extracts from curly-leafed, iceberg, little gems, and romaine varieties displayed notable antibacterial activity against *Yersinia enterocolitica* (MIC value 0.007 mg/mL).

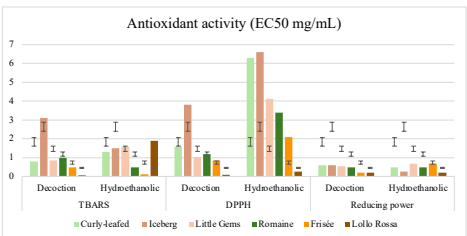


Figure 1. Antioxidant activity of the hydroethanolic and decoction extracts of different lettuce varieties (mean ± SD, n = 9).

Conclusion

Overall, the biochemical characterization of *L. sativa* WL highlights their potential as a source of valuable bioactive compounds and supports a sustainable approach to managing agricultural residues.

References
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This work offers sustainable solutions for bio-waste, leveraging innovative Technologies to promote a circular economy and enhance food safety. It aligns with the 2030 Agenda goals by reusing agri-food waste, developing new products, and reducing waste generation (goals 12.5; 12.a). It also supports the vegetable industry in reducing industrial waste through innovation and research (goals 9.4; 9.5).

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