Harnessing the Economic, Nutritive, and Commercial Potential of Pomace through UPE

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**Introduction**

136 million tons of food processing waste (FPW) is dumped into landfills. Food scraps makes up 14% of the total FPW produced each year.\textsuperscript{1}

**Key Takeaways**

<table>
<thead>
<tr>
<th>Global Impact</th>
<th>Food Wasted</th>
<th>Green House Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3 billion metric tons is wasted or lost from food processing waste\textsuperscript{2}</td>
<td>55 million metric tons of food waste per year in the USA\textsuperscript{3}</td>
<td>113 million metric tons of CO\textsubscript{2} is emitted into gas emissions\textsuperscript{3}</td>
</tr>
</tbody>
</table>

**Don't Waste the Waste**

- **Compost**
  - Organic Matter
  - Fertilizer or soil conditioner
  - Adds nutrients to the soil
  - Reduces pressure on landfills
  - Cost efficient
  - Rich in natural nutrients
  - Lessens Carbon footprint

- **Biofuel**
  - Filled with carbon and nutrient sources allowing for bioproduction of fuel.
  - Source of natural ingredients
    - Antioxidant
    - Anticancer
  - Utilizes all components of pomace

**Ultra-High Pressure Extraction**

- Ultra-high pressure extraction (UPE) is an extraction method that can be used to extract BAC's from nutritious food waste (pomace).
- The mode of action is Le Châlliers Principle
- During extraction, high pressure is used to deform the cell walls of the pomace, the damage to the cell walls allows for an enhanced rapid dissolution of BACs into the solvent.
- UPE can operate at low temperatures (suitable for thermolabile compounds) and uses GRAS solvents which is cost effective.

**Biologically Active Compounds**

<table>
<thead>
<tr>
<th>BACs</th>
<th>Bioactivity</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flavanols</td>
<td>Antioxidant</td>
<td>Natural preservative, Anticancer agents</td>
</tr>
<tr>
<td>(Quercetin)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carotenoids</td>
<td>Radical scavenger</td>
<td>Anti-inflammatories, anti-ageing formulations</td>
</tr>
<tr>
<td>(Carotenes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flavonones</td>
<td>Antioxidant</td>
<td>Cardio-protective agents, pain reliever in arthritis</td>
</tr>
<tr>
<td>(Hesperidin)</td>
<td></td>
<td></td>
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<tr>
<td>Dietary fiber</td>
<td>--</td>
<td>Swellable polymer in food</td>
</tr>
<tr>
<td>(Pectins)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Possible Products**

- Products could be produced from the pomace extract with natural antioxidants, anti-inflammatories, and would have no artificial contents added.
- Replace hazardous synthetic ingredients that are added to beverages and food products.
- The products developed could be used as natural flavorings for beverages and food.

**Summary**

- In summary the extraction of BACs using UPE provides short extraction time, effective extraction of thermolabile compounds and can be executed in large quantities.
- The amount of organic waste thrown out every year can be utilized through UPE methods to produce natural and antioxidant filled products. The results from this study will demonstrate why UPE should be used commercially for the natural extraction of BACs.

**References and Acknowledgements**

1. USA Map of vegetables Whyte, J. (NA). The new American diet. AARP The Magazine
4. Image taken from Jun Xi. Ultrahigh pressure extraction as a tool to improve antioxidant activities of green tea extracts, 2011
5. Image taken from Alamy stock photo, apple pomace, 2010
6. Image taken from instacart. Snapple all naturally sweetened peach passionfruit tea, 2019
7. Image taken from Synthesis, jelly beans, 2018
8. Image taken from Momendavors, refreshing summer snack: fresh & fruity grape popsicles, 2012

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