Effect of Coffee Cherry Pulp on Rheological Properties and Quality Parameters of Dough and Batters

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Coffee cherry pulp represents 50% of whole fruit.

The coffee cherry pulp could be used to fortify bread and muffins bakery products deficient in dietary fiber, among other nutrients.

Coffee world production in 2019: 10.5 million tons

(Mussatto et al., 2011; SAGARPA 2015)
Coffee cherry pulp powder (CCPP) and wheat flour proximate and caffeine analyses *

<table>
<thead>
<tr>
<th>Compounds</th>
<th>CCPP (g / 100 g)</th>
<th>Wheat flour (g / 100 g)</th>
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</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>6.1±0.0</td>
<td>12.58</td>
</tr>
<tr>
<td>Protein</td>
<td>9.7±0.1</td>
<td>11.87</td>
</tr>
<tr>
<td><strong>Dietary fiber</strong></td>
<td>44.5±0.6</td>
<td>2.37</td>
</tr>
<tr>
<td>Ash</td>
<td>4.2±0.1</td>
<td>1.09</td>
</tr>
<tr>
<td>Lipids</td>
<td>1.5±0.0</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td><strong>Caffeine</strong></td>
<td>0.04±0.0</td>
<td>n.a.</td>
</tr>
<tr>
<td><strong>Total carbohydrates</strong></td>
<td>33.96</td>
<td>71.09</td>
</tr>
</tbody>
</table>

*Means (n=2 ± standard deviation) of two independent analysis. n.a. = not analyzed.
**Total carbohydrates were calculated by difference.
Methodology

Coffee Cherry Pulp Powder
Particle size < 150 μm
1.25, 2.5, 5 % Bread dough
10, 20, 40 % Muffins batters

Creep-recovery and Frequency sweep
Bread-making method AACC1 10-10.03
Crumb firmness AACC1 standard procedure with TA-XT2

Frequency sweep on muffins batters
Comercial muffins recipe
AIB standard procedure for muffins firmness
Figure a): Creep-recovery curves for gluten, with different levels of coffee cherry pulp powder (CCPP) substitution. Graphs plotted with averages of Kelvin-Voigt model.

(Hernandez et al., 2017)

Figure b): Creep-recovery curves for dough, with different levels CCPP substitution.

Kelvin-Voigt model

\[ J(t) = J_0 + J_1 \left(1 - e^{-\frac{t}{\lambda_1}}\right) + J_2 \left(1 - e^{-\frac{t}{\lambda_2}}\right) + \frac{t}{\eta_0} \]
When the substitution level of CCPP increased, muffin batters showed more solid-like behavior.
The crumb firmness increases with CCPP substitution, as opposed to the volume reduction on bread and muffin due to dilute the protein network and weaken the gluten matrix formation.
Conclusions

The CCPP is a good source of dietary fiber.

The substitution of wheat flour by CCPP increases the stiffness of dough and gluten. It can be seen with the reduction of max strain when 100 Pa of stress was applied.

This first approach has been performed without dough or bread additives (emulsifiers, enzymes, etc.), so more research should be done using dough and bread.

Significance

Coffee cherry pulp valorization as an ingredient in baked products is a way to add nutritional value and to reduce its waste and environmental impact. Burgers model parameters are good predictors of bread quality and power law model parameters for muffins quality.