**Optimization of Simultaneous Microwave-Ultrasound Assisted Extraction of Bioactive Compounds from Bark**

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**Highlights**

* Pine bark was used as source for extraction of biomolecules.
* Potential use of simultaneous microwave-ultrasound assisted extraction (SMUAE) was demonstrated.
* Conditions for the optimum extractions were determined.

**1. Introduction**

Trees, which are constituted by wood and bark, are a very used natural source where bark is considered as waste. Taking into account that bark is about 9-15% of the total value of the tree [1] it could be consider as available cheap feedstock for biorefinery. Bark is a heterogeneous material and contain large number of bioactive compounds. These compounds could be applied in wide range of applications from bio-based material to pharmaceutical and chemicals.

The selection of an optimum extraction technique acquires a considerable importance due to the low amount of bioactive compounds present in tree barks. The most widely used technique is the solvent conventional extraction which require a huge amount of solvents, time and energy consumption. In order to improve the sustainability of the extraction process alternative extraction techniques are being investigated. Microwave assisted extraction (MAE) and ultrasound assisted (UAE) extraction are two of the most investigated options. They are considered as “Green techniques” because they permit the reduction of extraction time, volume of solvent and energy consumption leading to a higher extraction efficiency [2].

In this work, a simultaneous microwave-ultrasound assisted extraction (SMUAE) was studied and compared with the results obtained with a conventional extraction using pine bark (*Larix Decidua*). For that purpose, the optimization of the extraction yield was carried out varying the different parameters.

**2. Methods**

*Larix Decidua* bark was used with a particle size below 0.5 x 0.5 mm. The SMUAE was carried out in an ultrasound-microwave instrument (HIELSCHER UIP500hdT-MILESTONE flexiWAVE) using ethanol/water (50/50 (v/v)) mixture as solvent. Ten grams of dried bark were placed in a 500 mL borosilicate glass with a solid/liquid ratio of 1:10 (w/v). Before the extraction, the extracts were filtrated, and the yield of the extraction was calculated gravimetrically. The extraction yield was studied changing different parameters values (reaction time (minutes), power of microwave (W) and power of ultrasound (W)).

**3. Results and discussion**

The preliminary results of SMUAE yield of pine (*Larix Decidua*) bark extracts are shown in a figure 1. The results of three different experiments are represented. The first experiment correspond to 5 minutes reaction, 300 W of microwave power and 100 W of ultrasound power, which match with the optimum point obtained by Luo for the extraction of phenolic compounds from walnut flour [3]. The second experiment correspond to the lower reaction time and the lower microwave and ultrasound power (1 min, 100 W and 50 W), and the third one corresponds to an intermediate between experiments 1 and 2 (5 minutes, 200 W for microwave and 100 W for ultrasound).

**Figure 1.** Extraction yield of the three experiments for the extraction of pine bark.

The highest extraction yield was obtained for the third experiment with a very close value to the obtained in the second experiment (6.06 % and 6.05 % respectively). The lowest value was obtained for the experiment with the highest power used in microwave and ultrasound with a value of 5.37%.

**4. Conclusions**

The lowest extraction yield could be explained by the degradation of the compounds due to the application of an excessive power. The comparison of the result of the first and third experiments confirm the possibility of that degradation. Further work is ongoing to optimize the extractions conditions.

**References**

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