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water-green-solvent-lavender

Cruising Review

Water as a Green Solvent

Structured Data

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This webpage QR code

Historically lavender flower essential oil has been collected via distillation. The flowers are exposed to steam or boiling water which strips the oils from the plant. The essential oils are then separated from the water based on their relative densities.

PDF Version of the webpage (first pages)

<https://cruisingreview.com/smx/water-green-solvent-lavender.html>

Water as a Green Solvent Combined with Different Techniques for Extraction of Essential Oil from Lavender Flowers

1. Historically lavender flower essential oil has been collected via distillation. The flowers are exposed to steam or boiling water which strips the oils from the plant. The essential oils are then separated from the water based on their relative densities.
2. Distillation has two distinct drawbacks, the high temperatures involved tend to denature the more temperature sensitive aromatic compounds negatively affecting the sent and flavor of the resulting oil. Secondly, steam distillation is energy intensive driving up production cost and environmental impact.
3. This study compares the efficacy of ten different extraction techniques, with an emphasis on, quote - instant controlled pressure drop (DIC), supercritical fluid extraction (SFE), ultrasound assisted extraction, microwave extraction, enzyme-assisted extraction, and alternative solvents – unquote.
4. The use of water as an extraction solvent is ideal due to its low cost, low environmental impact as well as the fact that it is non-toxic and non-flammable.
5. Water is also advantageous when it comes to separating extracted organic compounds from the solvent. Room temperature organic compounds are mostly insoluble in water making for an easy separation.
6. The low solubility of organic compounds in water also is the biggest roadblock to widespread use of water as the primary solvent for organic oil extraction.
7. Under high temperature and high pressure, quote – conditions, water is able to solubilize more non- polar molecules – unquote.
8. The essential oils collected from each of the ten experimental setups were compared based on percent yield, time to complete extraction, energy requirement of the process, as well as quality of the oil based on an olfactory test.
9. The olfactory (smell) quality of each extracted oil was judged based on multiple aroma characteristics by C. Louis, a professional perfumer, in a single blind format.
10. When comparing the yield results of the ten setups, microwave steam distillation was by far the best performer. It generated the greatest yields and did so in the shortest extraction times.
11. Solvent free microwave extraction was also completed extraction in much less time than the eight other methods but only produced the 3rd highest overall yields. Ultrasound assisted hydro distillation produced the 2nd best yields, although in a timer frame similar to standard hydro distillation
12. The microwave steam distillation setup in this study was very similar to standard steam distillation where the botanicals were suspended above boiling water, but in this case the reaction chamber was heated via microwave energy.
13. The ultrasound assisted hydro distillation provided a pretreatment for botanicals mixed with water that used ultrasonic energy to rupture the cell walls prior to standard hydro distillation.
14. The difference between hydro distillation and steam distillation is based on the location of the botanicals. In hydro distillation the botanicals are mixed into the boiling water and the resulting steam containing essential oils is collected and separated. In steam distillation, the botanicals are suspended above the boiling water where passing steam dissolves the essential oil and carries it to collection.
15. Experimental setups involving microwave assisted extraction were shown to be the most environmentally friendly, primarily due to the speed with which the extractions were able to complete.
16. Essential oil extracted via microwave assisted methods averaged, quote – 0.298 kW h^{-1} per gram – unquote, where as the control required, quote – 3.452 kW h^{-1} per gram of essential oil for Hydro Distillation – unquote.
17. Across the five categories: yield, extraction time, degradation (quality), environmental impact, and cost, Subcritical water extraction and Turbo-hydro extraction were clearly worse than the control (HD). Ultrasound assisted hydro distillation produced a greater yield than standard HD but came up short in all other aspects. Only methods involving the use of microwave energy were clearly advantageous compared to the HD process.
18. The author of this study, quote – identified the optimal extraction technique as being the steam distillation assisted by microwave (MSD) – unquote. Advantages of MSD include an average yield of 5.4 percent in 30 minutes compared to 4.6 percent in 120 minutes for hydro distillation. The significant reduction in reaction time also offers a significant reduction in energy requirement and equivalent CO₂ production. Based on the olfactory (small testing) lavender oil from

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