Essential Oil Recovery from an Entrained Air-Steam Mixture

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Background
• U.S. mint oil is of the highest quality and comprises 40% of world production
• Current steam distillation is not an energy efficient process
• 100 kW experimental microwave system was created to improve energy efficiency

Problem: The recovered steam/oil is entrained with air which makes the current condenser system incapable of total condensation and recovery

Approach
The pilot plant was simulated at 3% of its dimensions in order to test the two condenser options. Steam from Oregon State pipelines was used in place of the microwave applicator. Mint oil was delivered with a calibrated sprayer.

Steam Delivery
• SS steel pipes deliver house steam.
• Hood system captures the steam/air mix and sends it to the condensers.
• Temperature and humidity sensors monitor outlet conditions

Results

Tube and Shell Condenser

Direct Contact Condenser

• Similar to the results of Colburn et al., the recovery which is directly proportional to the effective heat transfer coefficient has a power of 0.0335. Colburn et al reported 0.0338.

Conclusions: The low steam to air ratio makes a condenser system unlikely for economic feasibility based on the large size and high water flow rates needed.

Conclusion
The direct contact condenser seems promising. Mint was sprayed at 1.5 g/min into the inlet air mixture. A thick viscous layer of mint oil separated in the direct contact condenser basin. The collection system must be optimized in future studies.

Additional benefits to the scrubber system are that minimal water is added to the condensate if the water phase is cooled and re-sprayed. Additionally the oil/water separation techniques currently used can remain in use. This could encourage integration of this condenser into current practices.

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References