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Development of hybrid solar distillation system for essential oil extraction

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Abstract

Use of solar energy for cooking and steam generation is quite common around the world. However, use of solar energy for extraction of essential oils from medicinal and aromatic plants has recently been explored and its effects are still largely unknown. The current study is about essential oil extraction using a newly designed solar distillation system. The devised system consists of a primary reflector (Scheffler concentrator), steam receiver, distillation still, condenser and a florentine flask to enable extraction of essential oils from biomass. An auxiliary biomass system was also coupled with the distillation unit to complement the system during adverse weather conditions or seasonal climatic conditions throughout a typical year. The experimental results show that essential oils from fresh Eucalyptus leaves (*Camaldulensis*) and Peppermint leaves (*Mentha peperita* L.) were 0.59 % w/w and 0.40 % w/w, respectively. Essential oil from Pinus (*Roxburghii*) was extracted using a biomass boiler yielding 0.31% w/w of essential oil. GC-MS analysis confirmed the presence of Eucalyptol (50.9%), Menthol (93.0 %) and α -Pinene (70.9 %) as the major compounds in Eucalyptus, Peppermint and Pinus, respectively. In summary, solar-based distillation has proven to be a cost effective way of extracting essential oils from medicinal plans and herbs.

Keywords: Solar distillation system, essential oil, biomass boiler, GC-MS analysis, Eucalyptus (*Camaldulensis*), Peppermint (*Mentha peperita* L.) and Pinus (*Roxburghii*)

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