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## Biomass Energy Utilisation in Solar Distillation System for Essential Oils Extraction from Herbs

ANJUM MUNIR, OLIVER HENSEL

*University of Kassel, Agricultural Engineering, Germany*

### Abstract

Utilisation of solar energy in agriculture provides an extraordinary opportunity to promote small scale agro-based industry especially in tropical countries. Innovative solar collectors have opened several fields of applications of solar thermal energy at a medium and medium - high temperature level in post harvest and food processing. Essential oils extraction from herbs through distillation process is one of the medium temperature agro-based industries which can play a vital role in improving rural development. These oils are very expensive and used in medicines, food, fragrances, perfumery and cosmetics etc. A solar distillation system was developed using Scheffler fixed-focus concentrator but it worked effectively only during sunny days. The degree of reliability desired of a solar process to meet a particular load can be provided by a combination of properly sized collector and an auxiliary energy source. In the most climates, auxiliary energy is needed to provide high reliability and avoid gross over design of the solar system. For this purpose, solar distillation system is integrated with biomass energy to operate during adverse climatic conditions. The auxiliary biomass system comprises of a boiler, biomass furnace, and economiser and equipped with all safety mountings. The boiler operates under natural draught with the help of a chimney for efficient combustion process and can be operated with firewood, dry straw etc. The main object of the work is to utilise solar energy as a primary heat source and the rest is provided by biomass boiler. The steam connection of the biomass boiler is injected into the distiller while bottom of the distiller is always exposed to beam radiations coming from the fixed-focus solar concentrator. The average operating parameters for distillation temperature, power and efficiency of solar distillation system during sunny hours were found to be 100°C, 1.55 kW and 33.21 % respectively as recorded from the sensor system. The fluctuations of these parameters due to adverse climatic conditions are compensated by make-up steam line from biomass system. The paper presents the development, evaluation and experimental results of solar distillation system integrated with biomass energy for on-farm extraction of essential oils.

**Keywords:** Biomass boiler, essential oils, fixed-focus concentrator, herbs, natural draught, solar distillation