



Tropentag, October 7-9, 2008, Hohenheim

“Competition for Resources in a Changing World:  
New Drive for Rural Development”

## Experimental Results of Essential Oils Extraction from Herbs using Solar Energy

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### Abstract

With the increasing population and industrialisation, there is need to cut down the load of fossil fuels and to reduce environmental pollution. A large part of industrial process heat lies from low to medium temperature range which can be supplied by solar energy. The promotion of small scale agro-based industries by using innovative solar collectors can open new landmarks in rural development especially in tropical countries. The results of solar distillation are involved in “LILAC” project to promote agro-based industries. Essential oils are used in medicines, food, fragrances, perfumery and cosmetics and their extraction from herbs is one of the medium temperature agro-based industries that can play a vital role in promoting agriculture and farmer’s living standard. Scheffler concentrator was used for solar distillation system. The system was installed at solar campus, University of Kassel, Witzenhausen to avail fresh supply of different herbs. The system comprised of a paraboloidal type primary reflector (8 m<sup>2</sup> aperture area), secondary reflector (0.343 m<sup>2</sup>), steel boiler, condenser and Florentine flask to separate the essential oils from hydrosol. Scheffler concentrator tracks the sun beam radiations by simultaneous rotation about two axes to focus on a stationary receiver. The solar distillation system was also equipped with Pyranometer and thermocouples to record real time data. The paper describes the development and experimental results of solar distillation system. In the first phase of the research, several trials were made to evaluate the performance of the system. Within the solar radiations range of 700–800 W m<sup>-2</sup>, the receiver temperatures were recorded between 300–400°C. Several water boiling tests were conducted in sensible and latent heat range at different column heights to test the system suitability for distillation of essential oils. In the average range of solar radiations of 739, the average power was found to be 1.58 kW and distillation system efficiency was found to be 26.79%. Different herbs like melissa, peppermint, lavender, fennel seeds, cumin, basil and cloves buds were used for solar distillation. The results of solar distillation were found similar to laboratory results showing that solar distillation can be successfully used for extraction of essential oils.

**Keywords:** Essential oils, hydrosol, Scheffler concentrator, solar distillation