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Fabrication, optimization and evaluation of an indirect heated forced air circulation type solar dryer for drying of *Pogostemon heyneanus* Benth

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Pogostemon heyneanus Benth. is an aromatic plant cultivated for extracting patchouli oil which is largely used in perfumery, pharmaceutical and food industries. The oil is extracted via steam distillation of shade dried leaves. The weaknesses in shade drying have highlighted the demand in innovation of an environmentally sound drying technique. The focus of the present study was to fabricate an indirect heated forced air circulation type solar dryer and evaluate its performances pertaining drying of patchouli herbage. Three different spreading levels; 0.1, 0.2 and 0.3 kg per square foot were used. In each trial, the same amount of fresh material as in the dryer was shade dried as the control. Drying conditions; temperature, humidity and light intensity and moisture loss were measured at the top, middle and bottom positions of the dryer and in the control at three-hour interval until the herb wet basis moisture content reached less than 15%. At the end of drying, essential oil was distilled using Clevenger arm apparatus. Finally, oil compositions were analyzed using gas chromatography mass spectrometry (GC-MS). All the drying conditions closely followed light intensity patterns. Oil contents of top and bottom trays were always lower than that of the middle as they were directly exposed to solar radiation. Spreading rate of 0.2 kg per square foot had the best oil content (1.32 %) and there were no significant differences in oil contents among top, middle and bottom trays. To dry the same quantity of material as in the dryer with 0.2 kg per square foot of spread, the time requirement for shade drying (control) was almost double (63 hours) as that for solar drying (30 hours) and shade drying had less oil content (1.28 %). Further, patchouli alcohol (23.77%) and α -guanene (3.73%) were found to be slightly increased under solar drying while α - patchoulene (1.47 %) and seychellene (2.58 %) were found to be slightly increased under shade drying. However, the effect of solar and shade drying techniques on overall oil composition was almost identical. Thus, the solar dryer under optimized conditions could be recommended over shade drying in terms of drying time, oil content and space utilization.

Keywords: Essential oil, Patchouli alcohol, *Pogostemon heyneanus*, Solar drying, Spreading rate

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