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Multi-pass solar air heating collector system for drying of screw-pine leaf (*Pandanus tectorius*)

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1 **Multi-pass solar air heating collector system for drying of screw-pine leaf**
2 **(*Pandanus tectorius*)**

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10
11 **Abstract**

12 An experimental investigation of solar drying of screw-pine leaf has been conducted in the open
13 space of the solar research site, Universiti Teknologi PETRONAS Malaysia (4.385693° N,
14 100.979203° E). Screw-pine leaf has been used for handcraft in many villages in Asia and
15 Africa. A transient state lumped element analysis was developed to determine the thermal
16 performance of the multi-pass solar collector system (MSCS) in accordance with ASHRAE
17 standards. The facility was assessed under the average daily solar irradiance of 412.6 Wm⁻² and
18 ambient temperature of 30°C over an air mass flow rate range from 0.010 kgs⁻¹ to 0.032 kgs⁻¹.
19 Drying kinetics profiles of screw-pine have been obtained and an improved range from 22% to
20 26% of instantaneous thermal collector efficiency has been recorded over the double pass
21 collector system (DPCS) while thermal energy storage has contributed 5-8% to system
22 performance. MSCS performance has been determined and achieved the thermal collector,
23 pickup, drying and exergy efficiencies of 58.73%, 66.95%, 36.04% and 27.23-86.82%,
24 respectively. The level of risk on the investment in MSCS has been measured using economic
25 indices to obtain a payback period of 0.75 year. The thermal loss through conventional collector
26 back plate has been prevented by integration of collector unit and the drying cabinet of the

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