DEVELOPMENT OF AN OPEN-ARCHITECTURE TEMPERATURE DATA LOGGER FOR HYDRO-DISTILLATION AGARWOOD OIL EXTRACTOR

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We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science

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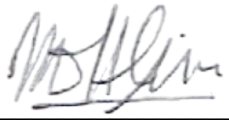

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ABSTRAK

Sistem perolehan data berasaskan pengawal mikro mutakhir ini muncul sebagai satu pilihan penyelesaian pengukuran yang berguna, fleksibel dan murah untuk pelbagai aplikasi lapangan yang inovatif seperti pemantauan alam sekitar, pertanian dan tenaga solar. Suhu masa-nyata sangat penting untuk memberi pengetahuan dalam proses penyulingan yang melibatkan pendidihan campuran, penyejatan dan pemeluwapan pada fasa cecair yang berbeza. Dalam kajian ini, sebuah peranti sistem perolehan data yang dinamakan OCTATherm dicipta untuk kegunaan industri pengekstrakan minyak pati gaharu telah direalisasikan dengan merekabentuk kotak elektronik untuk melindungi sistem pengawal mikro Arduino yang berupaya merekod lapan (8) bacaan termogandingan ketika memantau proses penyulingan-hidro. Ketepatan dan kebolehpercayaan peranti ini telah diuji pada penilaian proses penyulingan-hidro di dalam skala makmal dengan membandingkannya dengan peranti sistem perolehan data komersial, iaitu HOBO UX120. Akhirnya, penilaian di industri pula menunjukkan bahawa pemantauan suhu masa-nyata pada titik-titik kritikal sistem penyulingan-hidro konvensional dapat meningkatkan peratusan hasil ekstrak minyak pati gaharu lebih 3 kali ganda dari 0.027% kepada 0.101%. Oleh itu, penggunaan teknologi pengurusan haba masa-nyata terhadap sistem penyulingan-hidro dalam industri pengeluaran minyak pati gaharu terbukti penting dan lebih berkesan di dalam penyelidikan ini. Peranti OCTAtherm yang dibangunkan ini juga penting untuk menghasilkan platfom pengukuran suhu berdasarkan pemerolehan dan pemantauan data masa nyata, yang bertujuan untuk memantau proses di industri pertanian serta di bidang lain dalam penyelidikan. Reka bentuk sistem berasaskan senibina terbuka yang diketengahkan juga menyediakan potensi peningkatan dan pengembangan kepada pelbagai fungsi yang lebih baik di masa hadapan.

ABSTRACT

Microcontroller based data logger system recently emerged as a powerful, flexible and cost-effective measurement solution to many innovative field applications in environmental monitoring, agriculture and solar energy. Real-time temperature is vital to provide discrete knowledge in the process of distillation as it involves mixture boiling, evaporation and condensation at the difference in liquid phases. The development of a data logger namely OCTATherm for use in the Agarwood extraction industry is realized by designing an electronic enclosure to protect an Arduino-based microcontroller system that can acquire eight (8) thermocouples readings for monitoring the hydro-distillation process. The accuracy and reliability of the data logger have been evaluated by assessing the hydro-distillation (HD) process on a laboratory scale by comparing its performance to the commercial data logger (HOBO UX120). Finally, the assessment in the industry with multi-boiler operate simultaneously shows that real-time monitoring of the temperature measurements at critical points of the conventional HD system can improve the yield of the extracted Agarwood essential oil by three (3) times higher from 0.027% to 0.101%. The implementation of real-time thermal management technology in the HD system in the Agarwood essential oil production industry is therefore of great importance. This developed data logger is significant to produce a real-time data acquisition and monitoring platform of temperature measurement, which aims to facilitate agriculture industry process monitoring as well as academic research purpose in another area. The open-architecture based system design is also highlighted in which provides future upgrades of expansion and extension features of the data logger.

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