

Development of a Gas Sensor-Based Low-Cost Device to Estimate the Respiratory Activity of Microbes

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Measuring microbial activities on a substrate is important to select the best microbes for biological reactions, the best substrate for a particular type of microbes, to compare the performance of different types of microbes and different types of substrates for microbes, and also to understand the biochemical kinetics of microbial processors. In this study, a low-cost respirometer was designed and fabricated to measure the respiration activities of microbes on a substrate. The respirometer was designed to measure oxygen concentration, carbon dioxide concentration, and temperature using Figaro KE25 oxygen sensor, Figaro CDM4160H00 carbon dioxide sensor and LM35 temperature sensor, respectively. The sensor responses were fed into an Arduino Uno processor embedded in a circuit board fixed with data logging memory card. The automatic data acquiring, and logging system was designed using pascal programming. The sensors were calibrated using standard and inert gases and trial data logging were conducted to verify the accuracy of logged data. The respirometer testing was done by measuring the oxygen consumption and carbon dioxide emission from a sample of waste with known substrate properties. The results showed that the developed respirometer is capable of accurately measuring oxygen, carbon dioxide and temperature in a closed respirometer assembly which can be used for estimating microbial respiration activity. The used sensors were sensitive to high relative humidity; therefore, the system should be improved to avoid the damage to the system by high relative humidity.

Keywords: Arduino uno, Microbial respiration activity, Respirometer, Sensors

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