Development of a Low Cost Thermocycler with Sample Temperature Prediction Model

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The thermocycler is an apparatus widely used in molecular biology laboratories for the amplification of DNA using the PCR technique (Polymerase Chain Reaction). The main applications of the PCR technique are medical, forensic and research. Despite these many applications, thermal cyclers have an average cost of USD 15,000.00, which makes it difficult for low-income research centers and medical diagnosis clinics to have access to such equipment. The objective of this project was to create a thermocycler that is cheaper than thermocyclers commercially available, but with similar performance and operation, in order to attend the need of most PCR protocols. The implementation was made by replacing expensive components used in commercial thermoelectric thermocyclers with low-cost components with similar function and performance. In order to obtain more precise control of the sample temperature in the PCR cycles, avoiding overshoots, I used two statistic models, which provide the sample temperature in the PCR cycle, with an R^2 of 1 and a RMSE of approximately 0. The DNA samples amplified in the low-cost thermocycler were analyzed using gel electrophoresis and spectrometry. In gel electrophoresis the fragments were clear and well defined and the spectrometry showed that the samples´ curves amplified in the low-cost thermocycler follow the samples´ curves amplified in the commercial thermocycler. Total cost of components for the construction of the thermocycler prototype was approximately USD500,00, therefore reaching the intended goal.

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