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Study on thermophysical properties of nanofluids to enhance the efficiency of Polymerase Chain Reaction

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Statement of the Problem: A new challenge for thermal sciences provided by nanotechnology is nanofluids which are suspensions of nanoparticles in base fluids. Nanofluids exhibit with high thermal conductivity, so it can be further used to increase the efficiency of PCR (Polymerase chain reaction). In biomedical applications, PCR is one of the most popular tools in molecular diagnosis.

Methodology and Theoretical Orientation: Nanofluids can be prepared by two-step method by dispersing the nanoparticles such as Al_2O_3 and gold in the base fluids as water. Further proper sonication had done for 80 mins to maintain their stability. Thermal properties such as thermal conductivity, viscosity, and density of Al_2O_3 and gold nanofluids are measured and then used to enhance the efficiency of PCR.

Findings: Thermal nanofluids is 11% and 15% for 0.5% and 1% gold nanoparticles with size 60nm while for alumina fluids, there was the rise of 3% to 5% for 0.5% and 1% alumina nanoparticles concentration. Further, PCR mixture forms immediately precipitate when Al_2O_3 nanofluids are added in the mixture so Al_2O_3 is not fit for PCR. So, with the addition of gold nanoparticles in a PCR mixture containing DNA of size 0.8kb, it enhanced the efficiency of PCR by reducing the time cycle. Results show that PCR efficiency is more enhanced with an increase in size as well as the concentration of nanoparticles and by reducing the enzyme dilution.

Conclusion and Significance: Due to its unique thermophysical properties such as higher thermal conductivity and lower viscosity, nanofluids can implement in various heat transfer and biological applications.

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