The effect of calcium carbonate (caco3) nanoparticles on the flow through a pentagon spiral pipe

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Abstrak

CaCO3 is friendly to both the environment and humans. For this reason, it is suitable to be applied in fluid transportation to enable more efficient flow. The objective of this study was to investigate the effect of CaCO3 on the flow in a pentagon spiral pipe. The working fluid was circulated into the test pipe with constant pressure by the compressor. The working fluid was produced by mixing pure water with CaCO3 nanoparticles, which have average diameter of 100 nm, in the concentration ratios of 100 ppm, 300 ppm and 500 ppm. The test pipe was a pentagon spiral pipe with the ratio P/Do 7.1, and a circular pipe with a 4 mm inner diameter was used for comparison. The highest drag reduction (DR) that occurred in the spiral pipe was 35% around Re' 4×104 with nanofluids concentration of 500 ppm, while the highest DR in the circular pipe was of 26% around Re’ 4×104. The results show that increasing the percentage of solid particles affects the properties of the working fluid, such as viscosity, density, pressure drop and DR. The effects of the change in fluid properties were also taken into account. These affect the damping phenomena in the near wall region, which gives friction factor reduction. Another benefit of the spiral pipe is that it prevents the sedimentation of nanoparticles.