The Effects of Various Surfactants on the Efficiency of the Convection Processes Occurring within Ferrofluid

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Ferrofluids are highly viscous liquids that develop the properties of solids whilst remaining liquids in the presence of a magnetic field. When Ferrofluid is heated in the presence of a magnetic field, two convection processes occur, the first is the transfer of heat and the second is the movement of magnetised and non-magnetised particles. This experiment trialled the effect of Citric acid, Oleic acid and Lecithin, all commonly used surfactants, on the efficiency of the first type of convection process within Ferrofluid. The intention was to investigate a surfactant which can be used as a suitable replacement for the toxic surfactant, Tetramethylammonium Hydroxide currently used in most commercial fluids. The testing process involved calculating the difference between the maximum and minimum temperature at the top-most and bottom extremities of the fluid contained in a sealed test-tube. The Oleic acid proved to be the surfactant with the most efficient convection process, having the largest and most stable difference between the extremities recorded as 14.1°C. This was followed by Lecithin (5.16°C), Citric acid (0.31°C) and finally the Control solution with no added surfactant recording the least difference. These results suggest that the efficiency of convection within Ferrofluid is dependent on the surfactant's ability to combine with the carrier (its lipophilic or hydrophilic properties), which simultaneously form a tight intermolecular bond between chemicals and overcomes the Van der Waals force, thus preventing agglomeration.

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