



# CALIFORNIA STATE SCIENCE FAIR 2016 PROJECT SUMMARY

<b>Name(s)</b> <b>Denico M. Nieves-Ellis</b>	<b>Project Number</b> <b>J0119</b>
<b>Project Title</b> <b>Experimenting with Ferrofluid's Magnetic Properties: Searching for Novel Applications</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Ferrofluid is a magnetic liquid with some interesting qualities. Under the influence of a magnetic field, ferrofluid acts like a solid. It collects into one large semi# sphere that has many spikes on it. Some of the uses for ferrofluid include improved audio quality on loudspeakers, bio-medical purposes, and vacuum seals. I was inspired to experiment with ferrofluids to experience its benefits and drawbacks and try to discover more applications for ferrofluids.</p> <p><b>Methods/Materials</b> To conduct my experiments, I had to first conduct research and gather my materials, which included assorted containers, ferrofluid, neodymium magnets, and vegetable oil. I conducted more than fifty tests, experimenting to find if ferrofluid could move a solid mass when exposed to a magnetic field, as well as if viscosity affected ferrofluid's magnetic abilities, and whether ferrofluid could move solid mass from one area to another effectively and efficiently. I also conducted smaller side experiments to further my knowledge and understanding of ferrofluids.</p> <p><b>Results</b> My first experiments made me realize just how much I had underestimated the strength of ferrofluid while under the influence of a magnetic field. I observed through my tests that a ferrofluid can move a mass more than 20 times its own weight. My second experiment showed me that viscosity does in fact play a role in the performance of ferrofluid. My final experiments were at first unsuccessful, but when the mass being pushed was reduced and more iron oxide was added, the test weight was moved from one end of the test tube to the other.</p> <p><b>Conclusions/Discussion</b> I discovered I could use ferrofluid to move or push things within a small area by simply guiding it with a magnet, I immediately thought of ways I could incorporate this finding into society. In the end, I had an idea to use ferrofluid to get rid of clogs in pipes or drains by guiding it to the blockage with a magnet. This application is very much like its already existing bio-medical application, where it is guided to a lesion and drawn up, eliminating bacteria and infections. I would recommend more research be conducted on the study of ferrofluids. There are so many ways this material can benefit us in society that we don#t yet know. Hopefully, my findings can be applied in ways to benefit many people and inspire scientists to explore further, perhaps focusing on transportational uses and conveyor systems.</p>	
<b>Summary Statement</b> I sought to find novel applications for ferrofluids through various experiments and believe ferrofluids may be used for conveyor systems and even plumbing applications.	
<b>Help Received</b> I would like to thank my mother, father, and science teacher for their contributions to this project. I appreciate that they have stayed with me throughout the project and supported me by providing many of my materials, as well as taking photographs and videos of my experimentations.	