“LONG RANGE ATTRACTION BETWEEN POLYECTROLYTE MICROCAPSULES”

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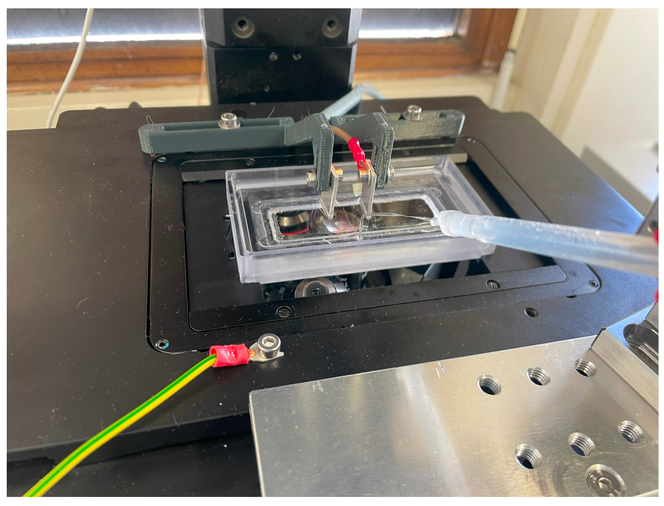
Gels are thick mixtures of liquid and solid particles with many various applications. Experimental study with bigger particle gels (non-colloidal gels) showed electrostatic charges influenced interactions between these gels or microcapsules, revealing attractive forces dependent on electrical fields.

Introduction

Colloidal gels consist of small solid particles in fluid, creating a shape-holding, stress-resistant network formed by particle interactions [1]. Strong-structured non-colloidal gels exist, with an experiment revealing long-range attraction between particles. The study seeks to comprehend this, using custom tools and electric fields to measure forces.

Methodology

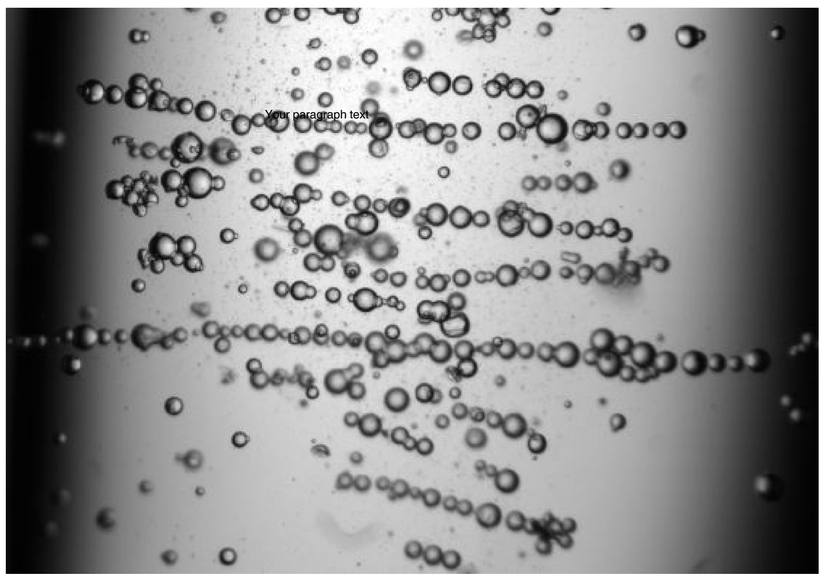
Microcapsules formed by an aqueous and oil phase were created through batch emulsification resulting in size ranging from 250-450 micrometers in diameter [2]. Glass capillaries were modified to act as force sensors [3] when holding the microcapsules and later repurposed as micro-manipulators. An electric-field setup was adapted with an electric generator and a microscope with a moving platform.



Electric-field setup with micromanipulator holding a microcapsule.

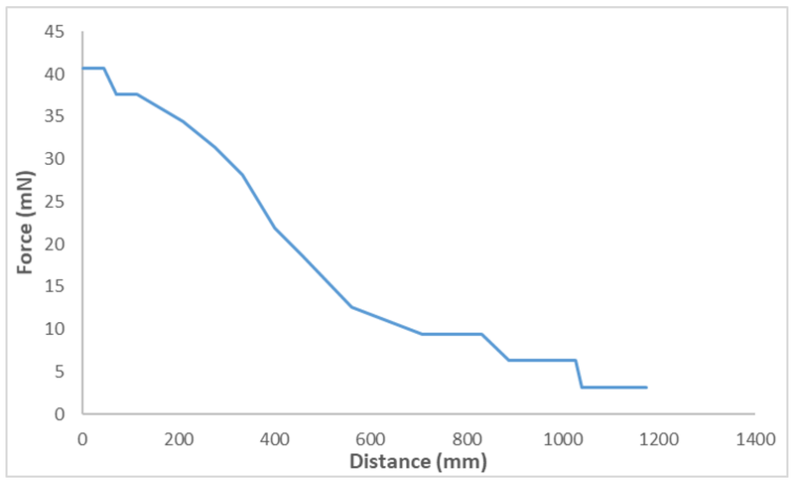
Results

A system with two micro-pipettes was used to measure attraction between microcapsules. Surprisingly, this attraction was due to electrostatic charges, disappearing when charges were removed. The dielectric properties of glass also influenced interactions. Experimental setup changes led to reproducible attraction experiments, quantifying the dipole moment. Microcapsules attracted, aligned, and merged in response to electrical fields.



Chain formation of microcapsules under an electrical field.

An electric generator revealed induced dipole effects causing random attraction between microcapsules. Successful replication of field experiments quantified dipole moments, showing microcapsules' attraction upon contact, oscillating until touch. The setup demonstrated microcapsules moving closer, aligning with an electrical field, accelerating exponentially upon reducing gap, and sticking or merging in a silicon oil bath.



Force measurement with respect to gap distance between microcapsules [4].

Conclusion

Although initial results were unexpected, the attraction force between microcapsules remains valid, arising from non-colloidal forces [5]. The observed long-range attraction, spanning hundreds of microns, differ from colloidal gels in the short-range. Induced dipoles due to electrical fields play a role, requiring further study for better understanding. Ongoing investigation aims to identify and quantify these interactions, crucial for comprehending gelation in non-colloidal particles.

References:

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