Surfactants on Oil/Water interface studied by modified Scheludko-cell

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Introduction

➢ Thin Liquid Films (TLFs)

➢ TLFs, formed by the continuous phase (the dispersion medium), are central to colloid science and have vast practical (technological and environmental) importance.

➢ TLFs are basic structural element of various dispersed systems widely spread in nature, including foam and emulsions.

➢ Through knowledge of the formation and stability of these intervening films gives enough information regarding the formation and stability of different emulsion systems.

Objectives

➢ The main objectives of this work are to develop experimental techniques for:

探索 possibility of developing new technique for real time analysis of film formation and its stability

➢ Exploring possibility of developing a technique for film formation detection at nanoscale

Background

O/W Emulsion Separation

➢ Thin Liquid Films (TLFs)

➢ TLF dynamics is the cornerstone of emulsion stability.

➢ Control on emulsion stability is of interest in industry.

➢ For instance, in Steam Assisted Gravity Drainage (SAGD), an in-situ oil sands operation, the extracted produced water (PW) is composed of water as the continuous phase, oil droplets which are dispersed in water, clay particles and dissolved organic matter (DOM).

➢ Measurement techniques for assessing emulsion stability is vital for controlling the stability of the emulsion.

➢ As emulsions are composed of one phase dispersed within another, its overall stability relies on the stability of the individual films of intervening continuous phase that separate the disperse phases.

➢ To stabilize the TLF, the presence of surfactants are necessary. SDS has been used in this work as surfactant in aqueous medium.

➢ The concept of Force Balance and disjoining pressure in TLFs

Design Concept and Fabrication

3D-Printed Designed Modified Scheludko-Cell (MSC)

➢ We used 3D-printing technology to fabricate a microfluidic cell to study the formation of Thin liquid films (TLFs)

➢ The MSC which has been designed using 3D CAD design software has been 3D-printed using Form2 3D-printer, using GPCL02 resin material

Experimental Setup

➢ The MSC is filled with the surfactant solution and using the syringe pump and Hamilton micro-syringe, the oil phase is injected into the system. The electrodes are applied in the cell in such a manner that they have the same height inserted in the upper and lower surfactant aqueous phase. The electrical conductance of the system is monitored using the Princeton Applied Research Potensio/ Galvanostat. Oil-phase TLF formation is then detected using the system resistance measurement.

Results

➢ Effect of different surfactant concentration on TLF conductivity (S/m)

➢ The concentrations of surfactants are (0.02, 0.05, 0.1, 0.2 wt% of SDS in milli-Q water)

➢ Adsorption dynamics of SDS surfactants at Oil-Water interface studied using our novel 3D-printed MSC

➢ In this study, a novel 3D-printed modified Scheludko-cell (MSC) has been used.

➢ An electrical modelling treatment for O/W interface has been done using resistors in series. Current vs voltage curve for the system composed of different SDS in mill-Q water as aqueous phase and n-dodecane as oil phase (TLF phase) has been obtained using the 3D-printed modified Scheludko-cell.

➢ we examined the effects of surfactants adsorption dynamics on TLF electrical behavior.

➢ Effect of different surfactant concentration on TLF conductivity (S/m) has been monitored and it was concluded that by increasing surfactant concentration, TLF conductivity has been increased.

Conclusion

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