# Design of Pickering emulsions stabilized with stearalkonium hectorite and hectorite for application in cosmetic products.

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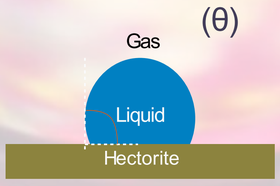
## INTRODUCTION

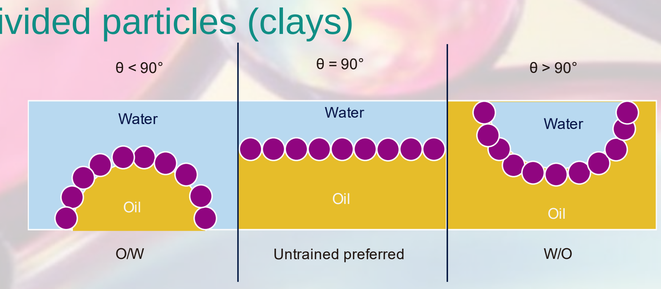
The Pickering emulsions, a type of emulsions stabilized by solid particles, have attracted attention in the pharmaceutical and cosmetic field due to their high resistance to coalescence. Surfactant-free emulsions have cosmetic applications where the surfactant often exhibits adverse effects. Hectorite and stearalkonium hectorite have physicochemical characteristics that can favor the stabilization of surfactant-free cosmetic emulsions. In this study, Pickering emulsions were prepared with stearalkonium hectorite and hectorite as solid particles and isopropyl myristate (IPM) and capric-caprylic triglycerides (CCTG) were used as oil phase. The contact angle of stearalkonium hectorite and hectorite was determined by the compressed disk method. The effect of the preparation variables on the formation of the emulsions was studied in a Box-Behnken type design, the factors to be evaluated: proportion of the oily phase (A), percentage of clays (B), water relation and oil (C), the responses to be evaluated were aspect, mm of separation and globule size. The emulsions were produced with the stearalkonium hectorite predispersed in the CCTG or IPM oil phase, using a rotor-stator type homogenizer. The leading emulsions are characterized by kinetic stability, globule size and distribution (TPP), and rheological behavior.

## MATERIALS & METHODS

### Characterization of finely divided particles (clays)

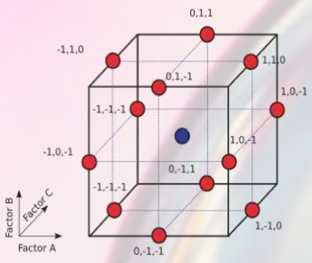
Determination of contact angle (θ)




### Determination of the effect of the composition on the formation of Pickering emulsions

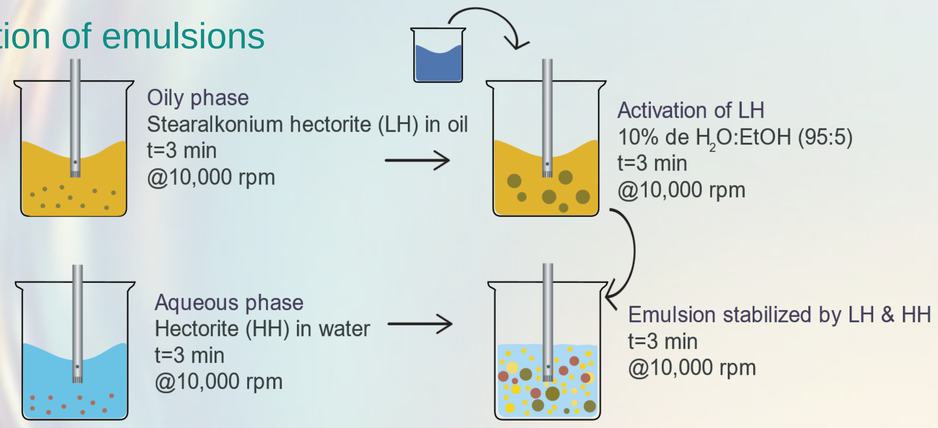
BoxBehnken-type design of experiments




| Factores | -1 | 0 | 1 |
|---|---|---|---|
| A | 02 | 05 | 08 |
| B | 01 | 05 | 1 |
| C | 0208 | 0505 | 0802 |

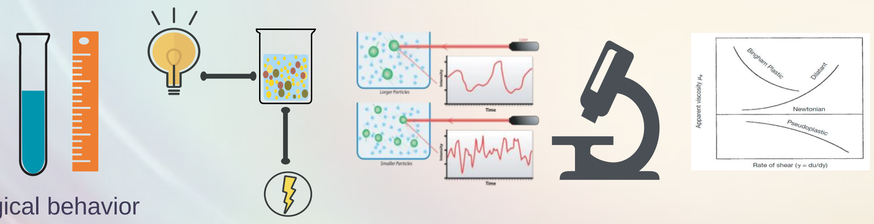
A Factor: Proportion of the oily pase
B Factor: Percentage of clays (hectorites)
C Factor: The hydrophilic clay: Lipophilic clay ratio

### Preparation of emulsions




### Characterization of emulsions

1. Kinetic stability
2. Emulsion type
3. Globule size
   -Optical microscopy
   -Laser Light scattering (polydispersity index)
4. Evaluation of the rheological behavior of the emulsion




## RESULTS & DISCUSSION

### Determination of contact angle


**Fig 1.**Drop of water formed into stearalkonium hectorite tablet.


**Fig 2.** Drop of IPM hectorite formed into stearalkonium tablet.

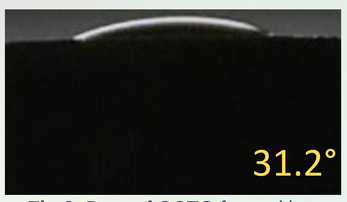



**Fig 3.** Drop of CCTG formed into stearalkonium hectorite tablet.

### Effect of the composition on the formation of emulsions

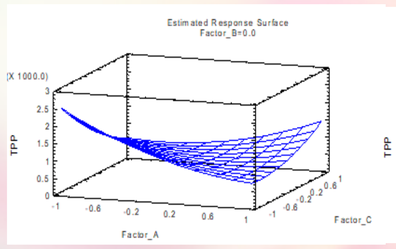



**Fig 4.** Estimated response Surface (C factor: The hydrophilic clay: lipophilic clay ratio)

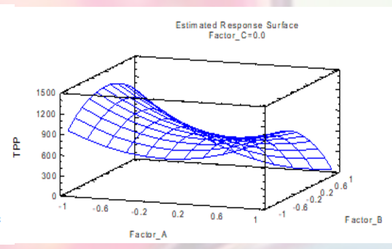



**Fig 5.** Estimated response surface (B factor: percentage of clays).

### Kinetic stability

**Fig 6.** Leader emulsion prepared with CCTG.

**Fig 7.** Leader emulsion prepared with IPM.

### Optical microscopy

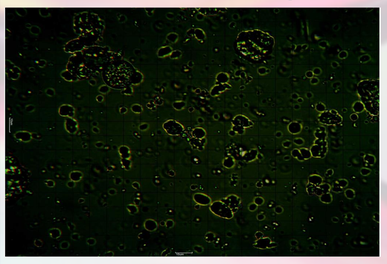


**Fig 8.** Leader emulsion prepared with CCTG.

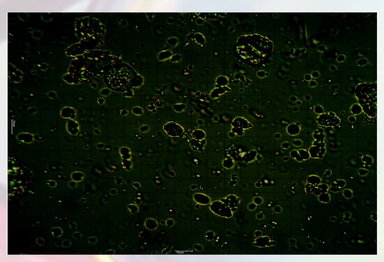


**Fig 9.** Leader emulsion prepared with IPM.

### Emulsion type/Globule size

**Table 1. Emulsion type and globule size:** Leader emulsions.

| Emulsion | Type of emulsión | Globule size | PDI |
|---|---|---|---|
| Leader emulsion with IPM | O/W | 1090.6 nm | 0.005 |
| Leader emulsion with CCTG | O/W | 4192.1 nm | 0.005 |

### Rheological behavior

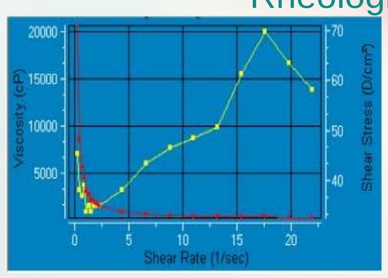



**Fig 10. Rheological behavior** Leader emulsion prepared with CCTG.

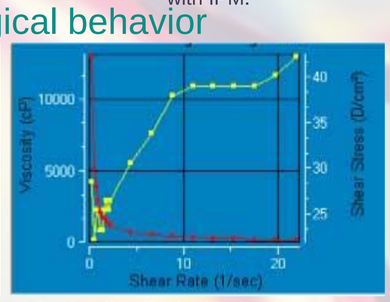



**Fig 11. Rheological behavior** Leader emulsion prepared with IPM.

## CONCLUSIONS

When the two hectorites are used together, the formation of highly stable emulsions is possible without the need to add surfactants, however, a precise ratio must be used. The rheology of the emulsions is determined by the total percentage of clays. In conclusion, simple and stable Pickering emulsions with hectorite and stearalkonium hectorite can be formulated with application for cosmetic use.

## AKNOWLEDGMENTS

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