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Data Article

Data set on stability comparison of emulsions stabilized by cationic fluorosurfactant against conventional surfactants and high thermal performance of fluoropolymer foams



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ARTICLE INFO

Article history:

Received 29 March 2017

Received in revised form

23 May 2017

Accepted 1 June 2017

Available online 6 June 2017

ABSTRACT

This data article includes emulsion stability comparison of cationic fluorosurfactant (CFS) against conventional surfactants. Span 80, Hypermer, Tween 80 and CTAB were used as conventional emulsifiers and only after 30 minutes bilayer phase separation observed in emulsions prepared by Tween 80 while CTAB failed to give fluoro-emulsion, as compared to the CFS stabilized fluoro-HIPE which demonstrated superb stabilization of more than 72 h without phase separation. Thermal stability of Poly(hexafluorobutyl acrylate)-Divinyl benzene (PHFBA-DVB) was compared with porous polymer prepared by the same concentration of CFS 9 wt% by using trifluoroethyl methacrylate (TFEMA) as monomer phase. Results of PFP prepared with HFBA showed remarkable stability performance at more than 340.69 °C while porous polymer synthesized by TFEMA started to decompose even at 237.36 °C. The main findings based on the data presented here are reported in the paper "A cationicfluorosurfactant for fabrication of high-performance fluoropolymer foams with controllable morphology" (Azhar et al., 2017) [1].

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DOI of original article: <http://dx.doi.org/10.1016/j.matdes.2017.03.064>

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<http://dx.doi.org/10.1016/j.dib.2017.06.005>

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Specifications Table

Subject area	Chemistry
More specific subject area	Organic chemistry
Type of data	Figure, Graph
How data was acquired	Digital camera(Cannon PowerShot SX210), Thermogravimetric analysis (TGA) was performed on Pyris Diamond TG/DTA (Perkin-Elmer Co.,USA),Contact angle instrument OCA dropshape analyzer (Data physics Co., Germany) for hydrophobicity test
Data format	Analyzed
Experimental factors	For thermogravimetric analysis, the polymer was grinded to form a powder before analysis.
Experimental features	TGA was performed at heating rate of 10 °C/min and a scanning range of 30 to 550 °C in nitrogen atmosphere, Contact angles images were taken after 2 minutes of droplets contact with polymer
Data source location	Jinan, China
Data accessibility	Data is with this article

Value of the data

- The data shows the importance of cationic fluorosurfactant in emulsion stability.
- This data may help to replace conventional surfactants which are unable to emulsify most of the fluoro-emulsion systems.
- It has been demonstrated in this data that the fluoropolymer shows high thermal stability up to 340° C.
- This data set will be beneficial for the researchers who want to work on high performance porous fluoropolymer foams.

1. Data

There is an increasing interest in fluorine containing oils and fluorinated surfactants/block copolymers in the field of emulsion polymerization due to their magnificent advantages over hydrocarbons just like compatibility with numerous solvents, environmental stability, optical transparency, hydrophobicity and excellent chemical/oxidative stability [2,3]. Fig. 1 describes the stability of fluoroemulsions prepared by different surfactants with same 9 wt% concentration in each vial. High performance of fluoropolymer foams and importance of fluorine contents in fluoropolymer are described in Fig. 2. The effect of cationic fluorosurfactant concentration on thermal stability and hydrophobicity of fluoropolymer foam is depicted in Figs. 3 and 4 respectively.

2. Experimental design, materials and methods

2.1. Emulsion stability

After preparation of high internal phase emulsions, these were taken in glass vials for digital photographs. As shown in Fig. 1, the emulsion prepared by cationic fluorosurfactant(CFS), Span 80 and Hypermer demonstrated good stability, while conventional cationic surfactant (CTAB) were unable emulsify the fluoro-emulsion. In Figs. 1a and b it can be seen that emulsions are viscous and stable even after 72 h, but these emulsions did not give regular interconnected polyHIPE morphology [1].

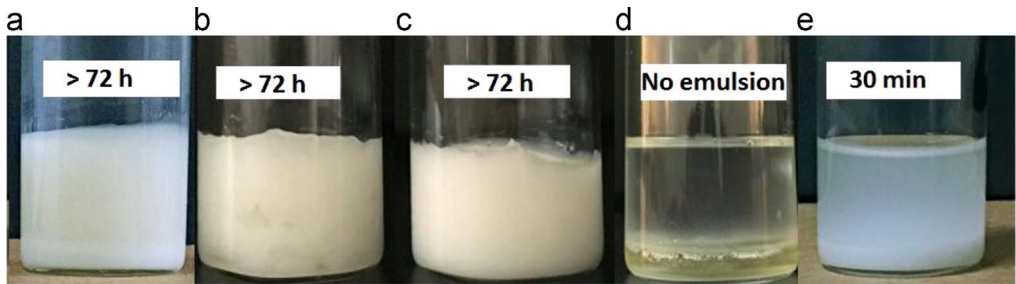


Fig. 1. Stability comparison of fluoroHIPE systems stabilized by: (a) CFS, (b) Span 80, (c) Hypermer, (d) CTAB, and (e) Tween 80.

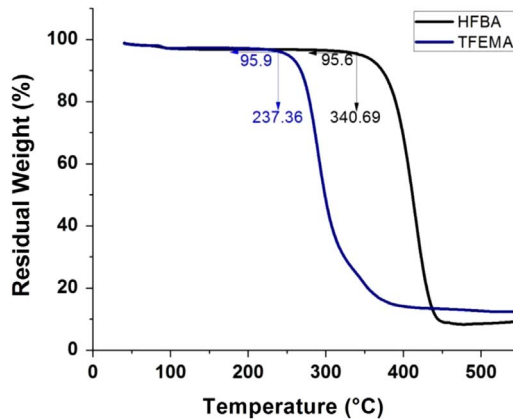


Fig. 2. Effect of change in monomers on thermal stability.

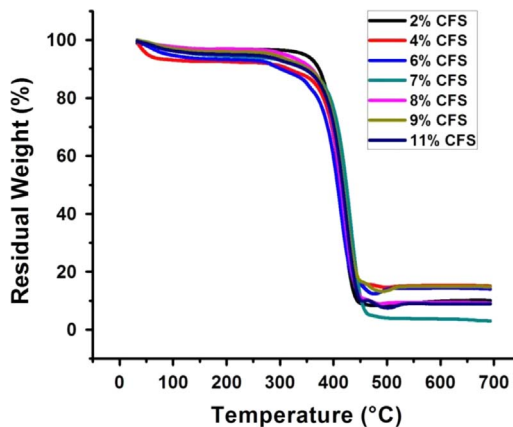


Fig. 3. Effect of change in concentration of CFS on thermal stability.

2.2. Thermal performance of fluoropolymer

Fluoropolymers were prepared by polymerization and drying of high internal phase emulsion and samples were grinded to make in powder form. Then, thermogravimetric analysis were performed by using Pyris Diamond TG/DTA (Perkin-Elmer Co., USA) with heating rate of 10 °C/min and a scanning

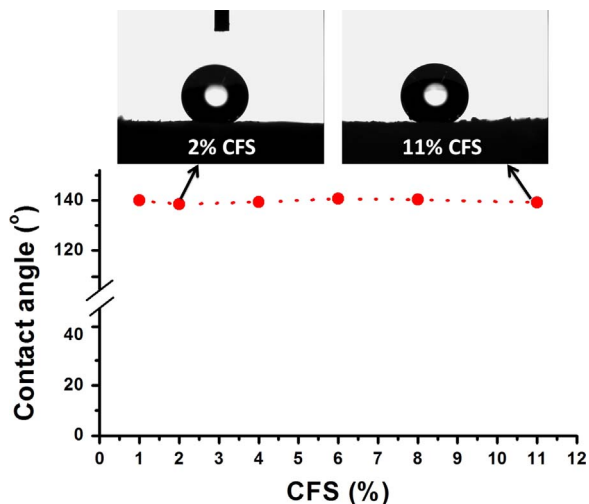


Fig. 4. Effect of change in concentration of CFS on hydrophobicity.

range of 30 to 550 °C in nitrogen atmosphere. Fig. 2 depicts the comparison between thermal stabilities of two fluoromonomers. PolyHIPE composed with HFBA(6 fluorine atoms) as monomer, showed high thermal stability than that of the polymer prepared with TFEMA (3 fluorine atoms) as monomer. Effect of CFS % on thermal stability of fluoropolymer is illustrated in Fig. 3. Thermal performances were then compared with the recent literature report [4], in which thermal stability of the emulsions prepared from hydrocarbons was discussed.

3. Hydrophobicity of fluoropolymer

Hydrophobicity of the solid materials is commonly specified by the contact angle measurement. If the contact angle $\theta \leq 90^\circ$ the surface is said to be hydrophilic and if $\theta \geq 90^\circ$ then the surface will be hydrophobic [5]. Here in, a contact angle instrument OCA drop shape analyzer (Data physics Co., Germany) was used to measure the hydrophobicity of porous fluoropolymer at room temperature. Images were captured after 2 minutes of the droplet stay on surface. Poly(HFBA-DVB) showed superb hydrophobicity with water contact angles ranged in 140° at almost all concentrations of CFS.

Acknowledgements

The work was supported by the National Science Foundation of China [Grant no. 21304037]; and the Scientific Research project of Shandong Provincial Department of Education [Grant no. J11LB02]. UA would like to acknowledge Rimsha Yaqub for insightful discussion and help regarding article.

Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.dib.2017.06.005>.

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