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Data Article

Data on characterization of nano- and micro-structures resulting from glycine betaine surfactant/kappa-carrageenan interactions by Laser Scanning Confocal Microscopy and Transmission Electron Microscopy

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ABSTRACT

This article contains data on the Laser Scanning Confocal Microscopy (LSCM) and Transmission Electron Microscopy (TEM) images related to multi-scaled self-assemblies resulting from 'green' cationic glycine betaine surfactant/anionic kappa-carrageenan interactions. These data gave clear evidence of the evolution of the micron-, nano-sized structures obtained at two surfactant/polymer molar ratios (3.5 and 0.8) and after the dilution of the aqueous dispersions with factors of 5 and 10 times. This data article is related to the research article entitled, "Monitoring the architecture of anionic κ-carrageenan/cationic glycine betaine amide surfactant assemblies by dilution: A multiscale approach" (Gaillard et al., 2017) [1].

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Specifications Table

Subject area	*Chemistry, Material Sciences, Soft Matter*
More specific subject area	*Structural analysis of nano-, micro- structures*
Type of data	*Figures*
How data was acquired	*Laser Scanning Confocal Microscopy (LSCM, Inverted Nikon A1 laser scanning confocal microscope (LSCM) and Transmission Electron Microscopy (TEM, JEOL JEM-1230 operated at 80 kV and equipped with a LaB6 filament*
Data format	*Analyzed*
Experimental factors	*LSCM: Aqueous dispersions of the surfactant/polysaccharide complexes were stained with 0.02% w/w acridine orange* *TEM: Sample-coated TEM grid was successively placed on a drop of an aqueous solution of uranyl acetate (2% w/w) for negatively staining, and on a drop of distilled water for rinsing. The grid was then air-dried before introducing them in the electron microscope*
Experimental features	*LSCM: samples viewed with Plan Fluor 4 × or 10 × Nikon objectives or with Plan Apo 20 × or 40 × Nikon objective by scanning using excitations brought about by the 488 nm emission and 561 nm emission lines of the He–Ne laser, and light emission was collected via a photomultiplier through a 500–530 nm and 570–620 nm band-pass filters, respectively. Images were processed using the NIS-Element* *TEM: micrographs were recorded on a Gatan 1.35 K × 1.04 K × 12 bit ES500W CCD camera.*
Data source location	*U.R. 1268 Biopolymères Interactions Assemblages INRA BP-71, 627 Rue de la Géraudière, 44316 Nantes Cedex 3, France*
Data accessibility	*Data is with this article*

Value of the data

- The given data provide structural information of particles based on multi-components at the micron- and nanometer scale range by using Laser Scanning Confocal Microscopy (LSCM) [2–4], and Transmission Electron Microscopy (TEM).
- The data provided by us help to understand the mechanism of formation of self-assemblies resulting from electrostatic interactions between multi-components.
- The data provided by us show influence of dilution on the architecture of assemblies composed of anionic polymers/cationic surfactants derived from renewable resources.
- The given data are useful to other researchers for developing applications of multi-scaled self-assemblies by mixing simply polymers and surfactants of opposite charge.

1. Data

Data refers to the LSCM and TEM experiments of 100% bio-sourced glycine betaine (GB) surfactant possessing a $C_{18:1}$ oleic fatty chain and kappa-carrageenan under pure forms in aqueous solutions (Fig. 1) or after their mixing at two different GB surfactant/κ-carrageenan molar ratios equal to *3.5* (sample A1: Figs. 2 and 3) and *0.8* (sample B1: Figs. 8 and 9) and after a dilution with a factor of 5 (*ratio 3.5* (sample A2): Figs. 4 and 5; *ratio 0.8* (sample B2): Figs. 10 and 11) and 10 (*ratio 3.5* (sample A3): Figs. 6 and 7; *ratio 0.8* (sample B3): Figs. 12 and 13) times. TEM observation shows the gradual dissociation of assemblies' nanostructures whereas LSCM identifies the distribution of cationic surfactant and anionic polysaccharide.

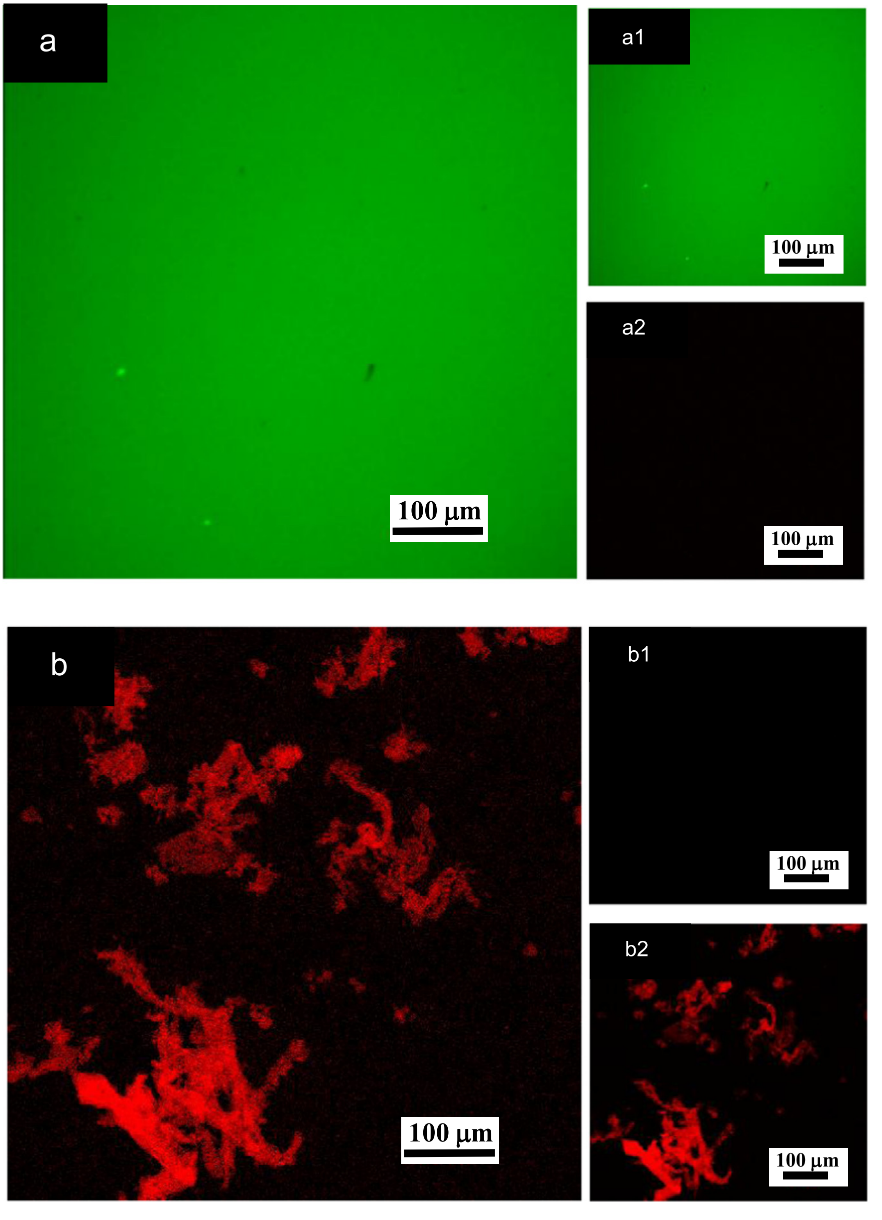

Fig. 1. LSCM images of aqueous solutions of (a) pure surfactant (10 g/L) and (b) pure κ-carrageenan (10 g/L) after fluorescence staining with acridine orange (0.02 % v/v). (a)–(b): LSCM green and red merged canals for both surfactant and κ-carrageenan emissions; (a1)–(b1): LSCM green canal corresponding to surfactant emission at 500–530 nm; (a2)–(b2): LSCM red canal corresponding to κ-carrageenan emission at 570–620 nm.

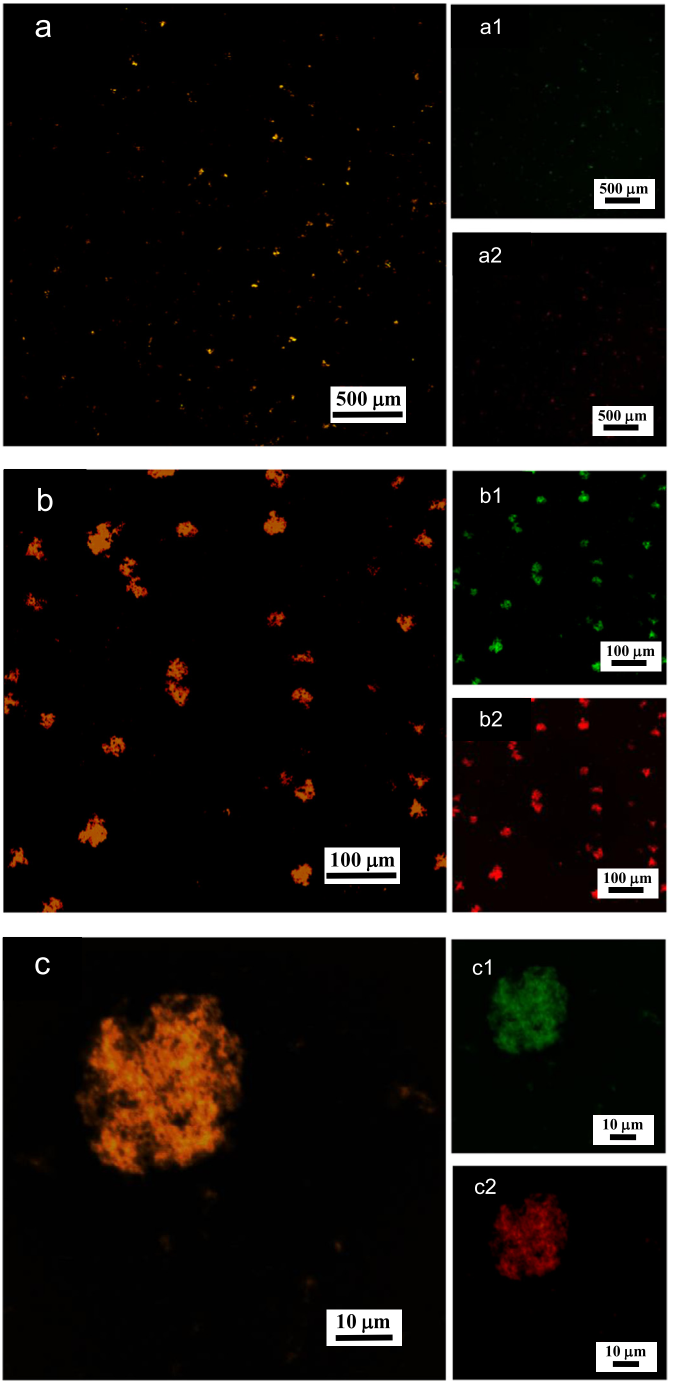

Fig. 2. LSCM images of aqueous dispersions (Sample (**A1**)) containing κ-carrageenan at a concentration of 0.825 g/L and surfactant at a concentration of 2.9 g/L. Sample (**A1**) was stained with acridine orange for which the surfactant and κ-carrageenan emissions correspond to 500–530 nm (green canal) for an excitation of 488 nm, and 570–620 nm (red canal) for an excitation of 561 nm, respectively. (a)–(c): LSCM green and red merged canals for both surfactant and κ-carrageenan emissions; (a1)–(c1): LSCM green canal corresponding to surfactant emission at 500–530 nm; (a2)–(c2): LSCM red canal corresponding to κ-carrageenan emission at 570–620 nm.

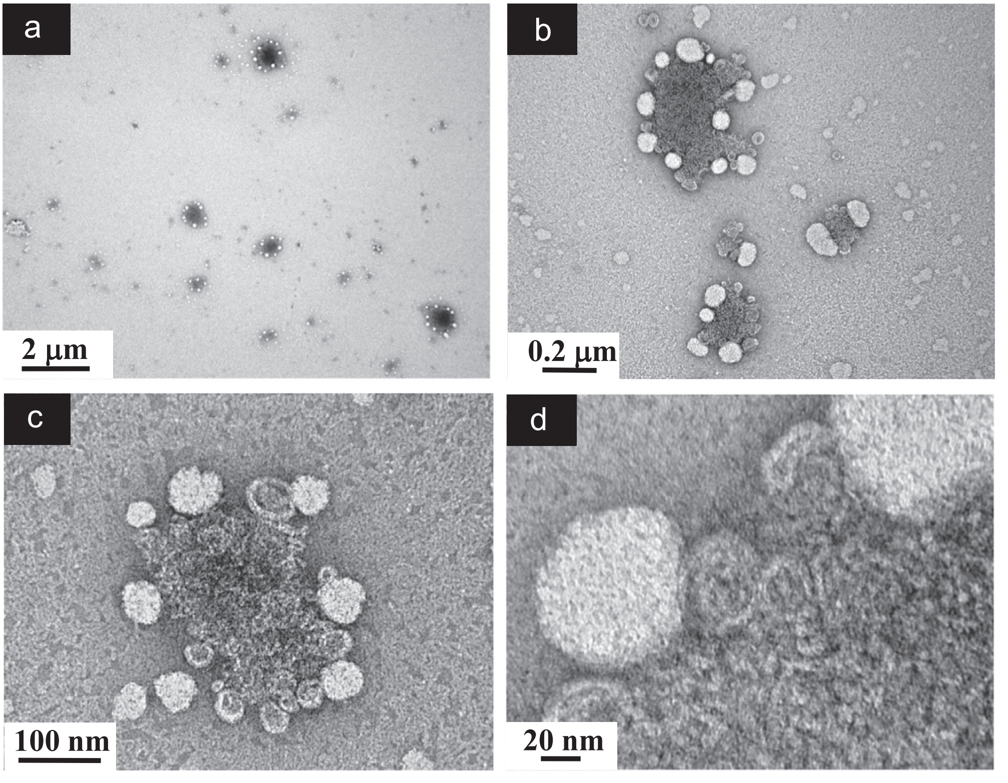

Fig. 3. TEM images of aqueous dispersions (Sample (**A1**)) containing κ-carrageenan at a concentration of 0.825 g/L and surfactant at a concentration of 2.9 g/L. (a): Global view showing sub-micronsized particles; (b)–(c): Higher magnification views showing the singular morphology of the Sample (**A1**) particles described by a compact core decorated with peripheral spherical-liked regions; (d): Details of the outer part of a particle showing peripheral spherical surfactant rich regions connected to rolled up κ-carrageenan chains located in the particle center.

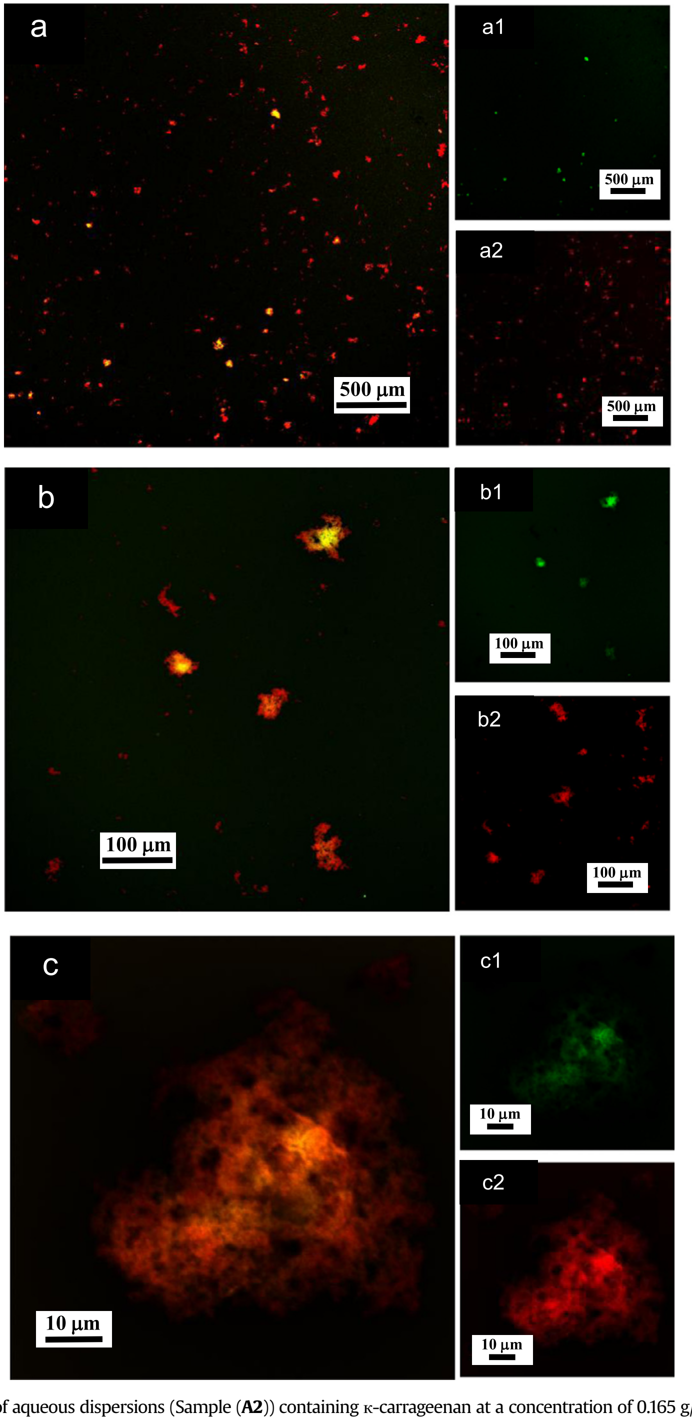

Fig. 4. LSCM images of aqueous dispersions (Sample (**A2**)) containing κ-carrageenan at a concentration of 0.165 g/L and surfactant at a concentration of 0.58 g/L. Sample (**A2**) was stained with acridine orange for which the surfactant and κ-carrageenan emissions correspond to 500–530 nm (green canal) for an excitation of 488 nm, and 570–620 nm (red canal) for an excitation of 561 nm, respectively. (a)–(c): LSCM green and red merged canals for both surfactant and κ-carrageenan emissions; (a1)–(c1): LSCM green canal corresponding to surfactant emission at 500–530 nm; (a2)–(c2): LSCM red canal corresponding to κ-carrageenan emission at 570–620 nm.

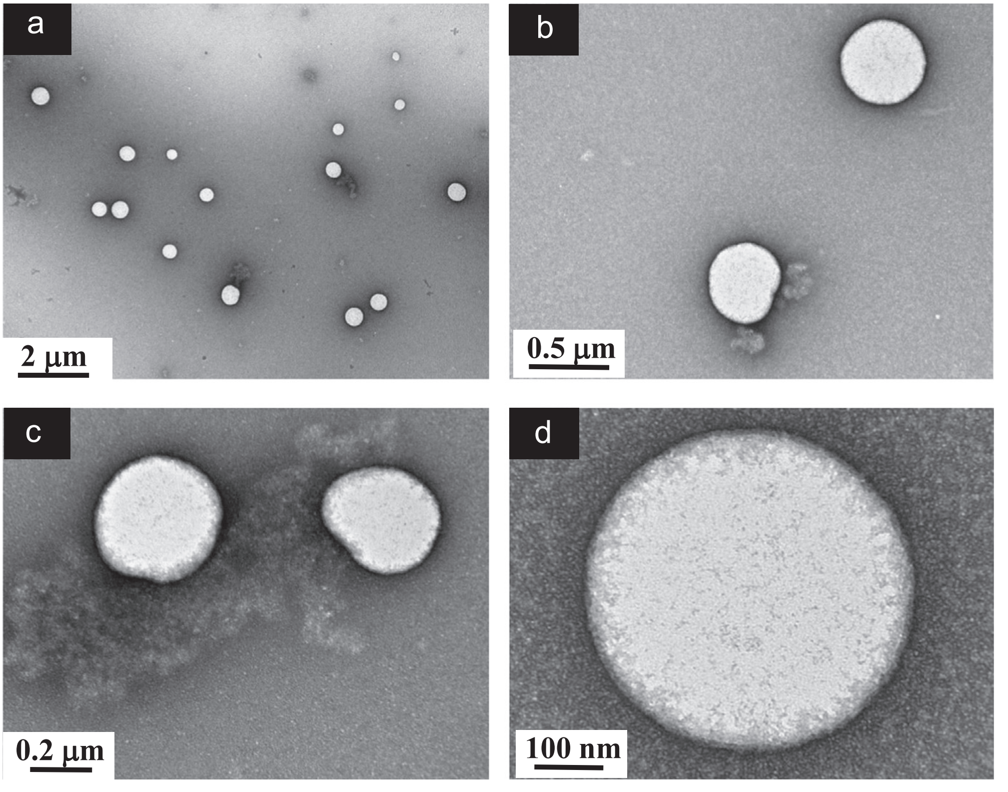

Fig. 5. TEM images of aqueous dispersions (Sample (**A2**)) containing κ-carrageenan at a concentration of 0.165 g/L and surfactant at a concentration of 0.58 g/L. (a): Global view showing sub-micronsized polymer-surfactant complexes; (b)–(c): Higher magnification views showing the singular morphology of the Sample (**A2**) particles; (d): Details of a spherical-liked particle attributed to surfactant rich zones of the complexes.

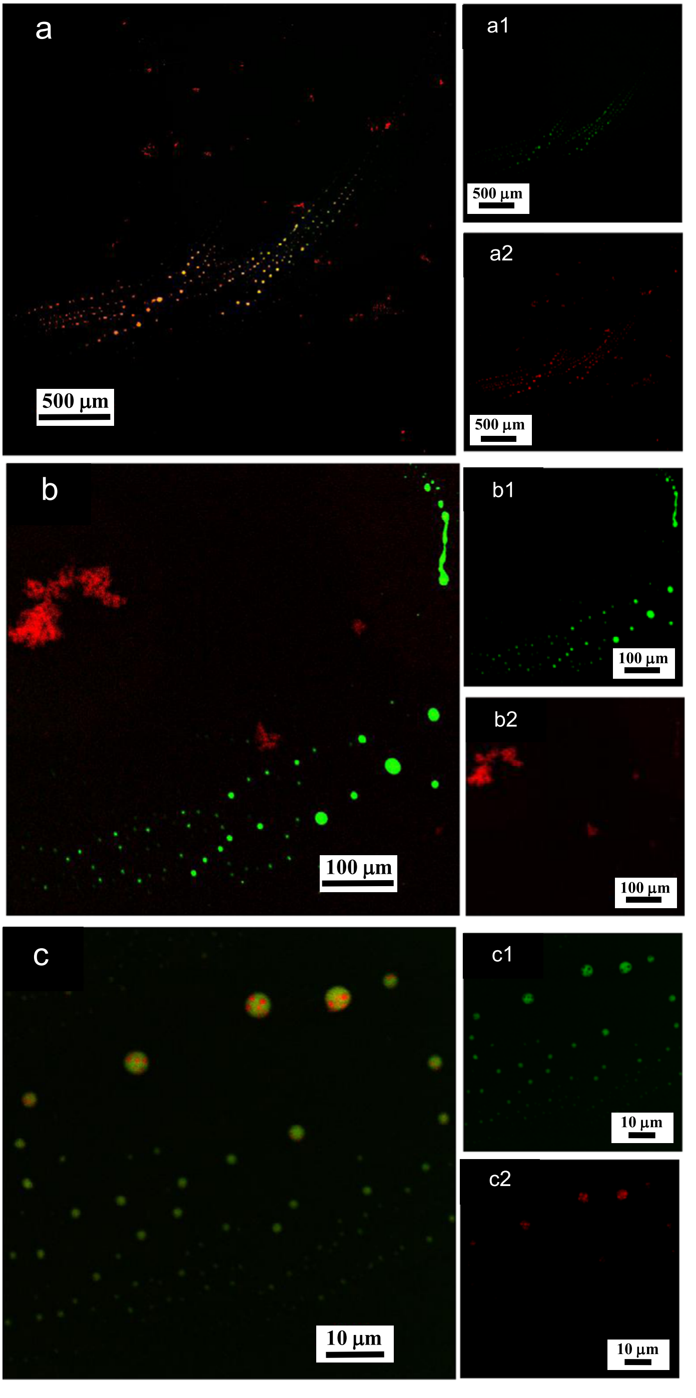

Fig. 6. LSCM images of aqueous dispersions (Sample (**A3**)) containing κ-carrageenan at a concentration of 0.0825 g/L and surfactant at a concentration of 0.29 g/L. Sample (**A3**) was stained with acridine orange for which the surfactant and containing κ-carrageenan emissions correspond to 500–530 nm (green canal) for an excitation of 488 nm, and 570–620 nm (red canal) for an excitation of 561 nm, respectively. (a)–(c): LSCM green and red merged canals for both surfactant and containing κ-carrageenan emissions; (a1)–(c1): LSCM green canal corresponding to surfactant emission at 500–530 nm; (a2)–(c2): LSCM red canal corresponding to κ-carrageenan emission at 570–620 nm.

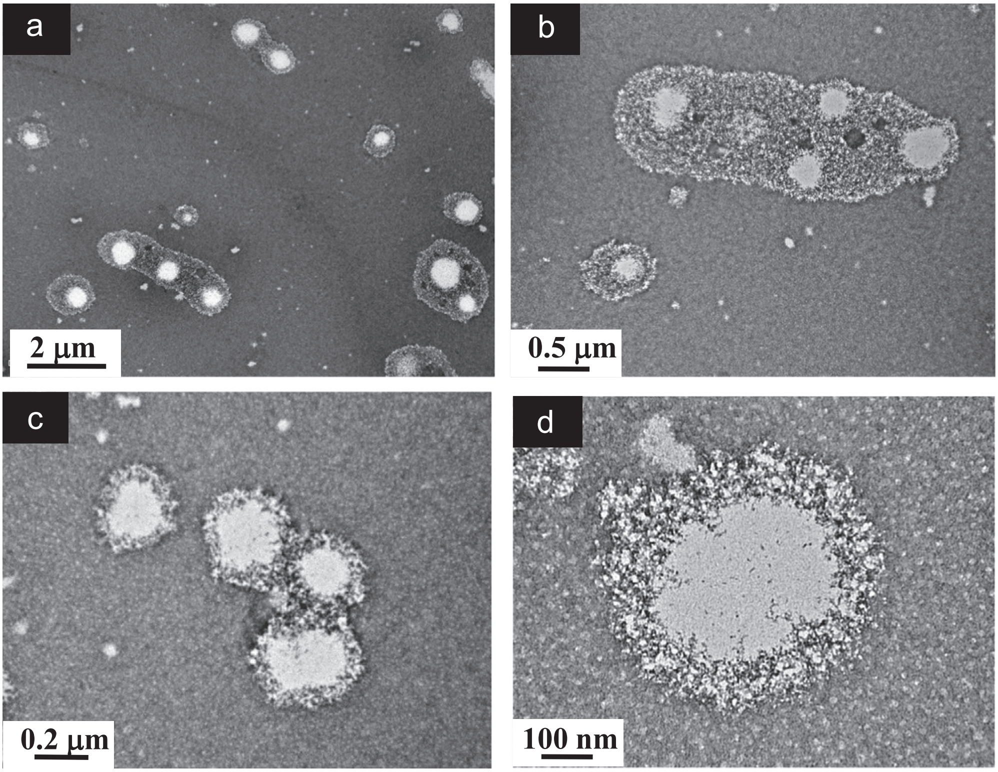

Fig. 7. TEM images of aqueous dispersions (Sample (**A3**)) containing κ-carrageenan at a concentration of 0.0825 g/L and surfactant at a concentration of 0.29 g/L. (a): Global view showing the morphology of the sub-micronsized polymer-surfactant complexes; (b)–(c): Higher magnification views showing the singular morphology of the Sample (**A3**) particles designed by a dense core and a discontinuous shaped shell; (d): Details of a core–shell particle where the core and shell are attributed to surfactant and polymer, respectively.

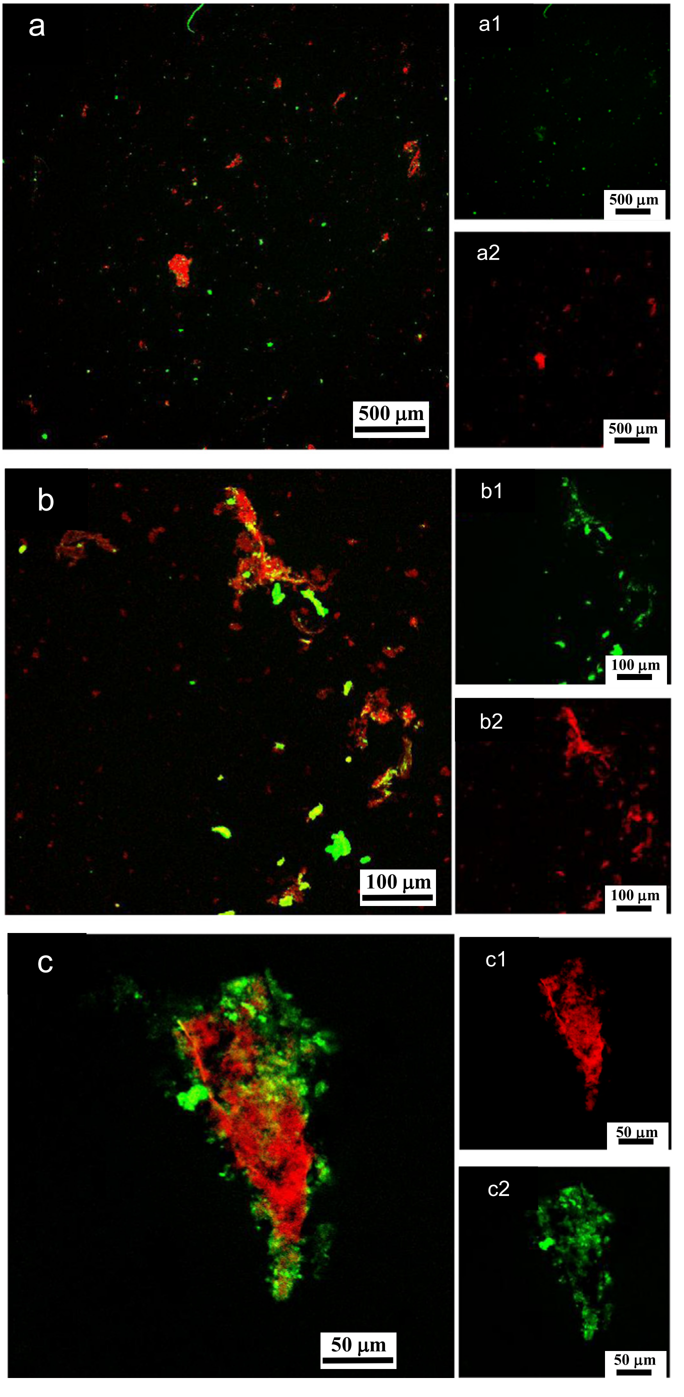

Fig. 8. LSCM images of aqueous dispersions (Sample (**B1**)) containing κ-carrageenan at a concentration of 0.95 g/L and surfactant at a concentration of 0.83 g/L. Sample (**B1**) was stained with acridine orange for which the surfactant and κ-carrageenan emissions correspond to 500–530 nm (green canal) for an excitation of 488 nm, and 570–620 nm (red canal) for an excitation of 561 nm, respectively. (a)–(c): LSCM green and red merged canals for both surfactant and κ-carrageenan emissions; (a1)–(c1): LSCM green canal corresponding to surfactant emission at 500–530 nm; (a2)–(c2): LSCM red canal corresponding to κ-carrageenan emission at 570–620 nm.

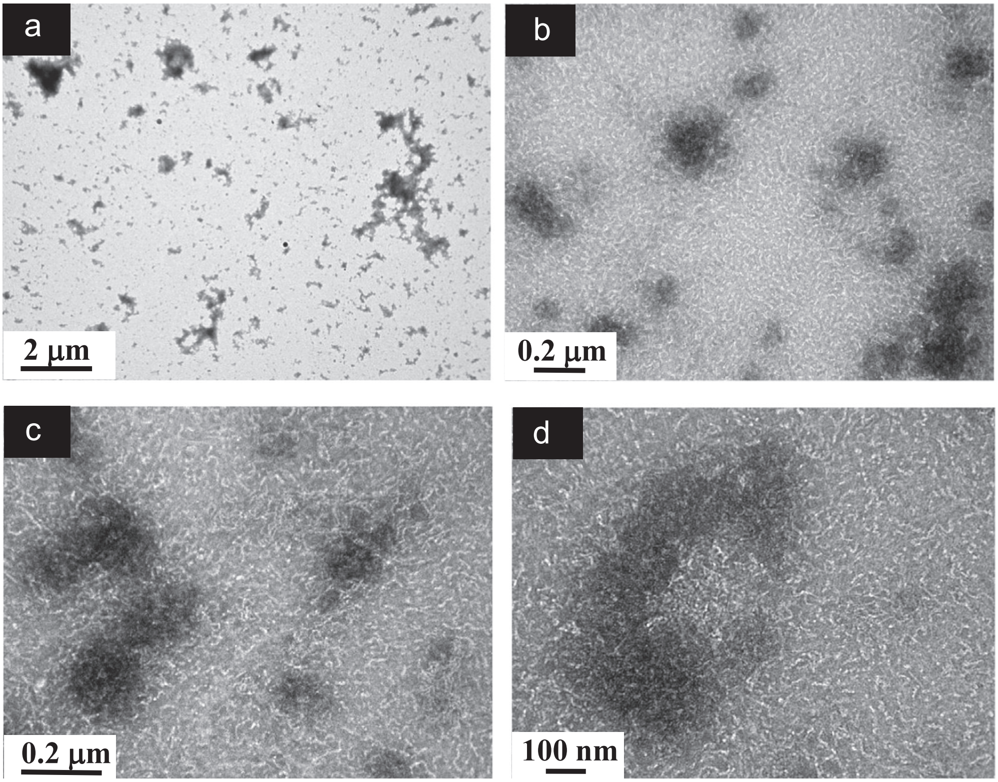

Fig. 9. TEM images of aqueous dispersions (Sample (**B1**)) containing κ-carrageenan at a concentration of 0.95 g/L and surfactant at a concentration of 0.83 g/L. (a): Global view showing particles of various sizes and shapes; (b)–(c): Higher magnification views showing the morphology of the Sample (**B1**) particles constituted by sub-micronsized more or less associated dense particles and numerous individual short chains located on the background; (d): Details of the chains attributed to κ-carrageenans and taking different configurations due to a relative flexibility.

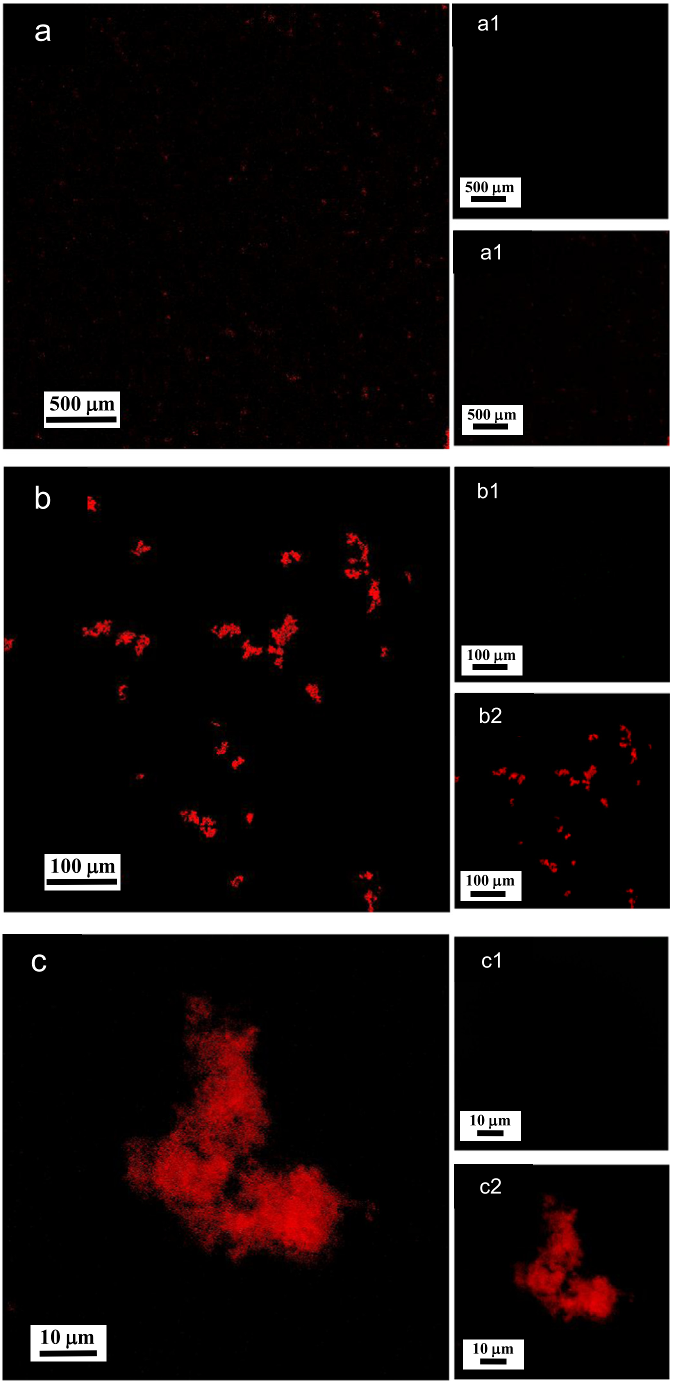

Fig. 10. LSCM images of aqueous dispersions (Sample (**B2**)) κ-carrageenan at a concentration of 0.19 g/L and surfactant at a concentration of 0.166 g/L. Sample (**B2**) was stained with acridine orange for which the surfactant and κ-carrageenan emissions correspond to 500–530 nm (green canal) for an excitation of 488 nm, and 570–620 nm (red canal) for an excitation of 561 nm, respectively. (a)–(c): LSCM green and red merged canals for both surfactant and k-carrageenan emissions; (a1)–(c1): LSCM green canal corresponding to surfactant emission at 500–530 nm; (a2)–(c2): LSCM red canal corresponding to κ-carrageenan emission at 570–620 nm.

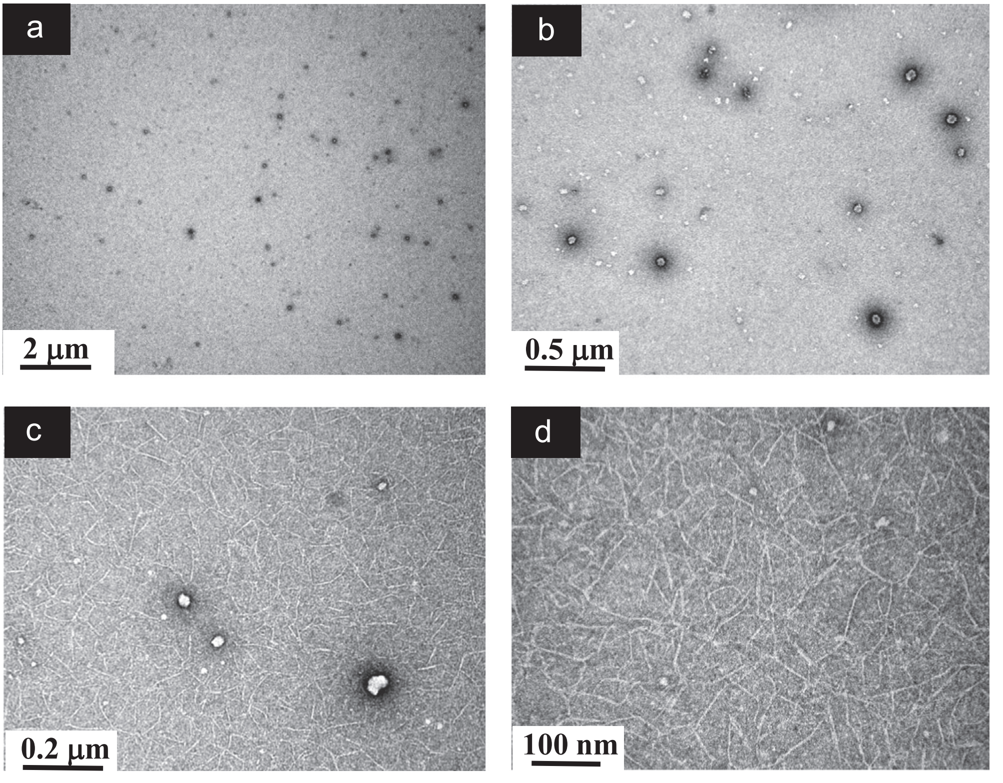

Fig. 11. TEM images of aqueous dispersions (Sample (**B2**)) κ-carrageenan at a concentration of 0.19 g/L and surfactant at a concentration of 0.166 g/L. (a): Global view showing a distribution of nanoparticles; (b)–(c): Higher magnification views showing the morphology of the Sample (**B2**) particles constituted by spherical-liked nanoparticles and numerous individual long rod-liked chains located on the background; (d): Details of the long chains attributed to κ-carrageenans with long rigid segments leading to a network of percolated rods.

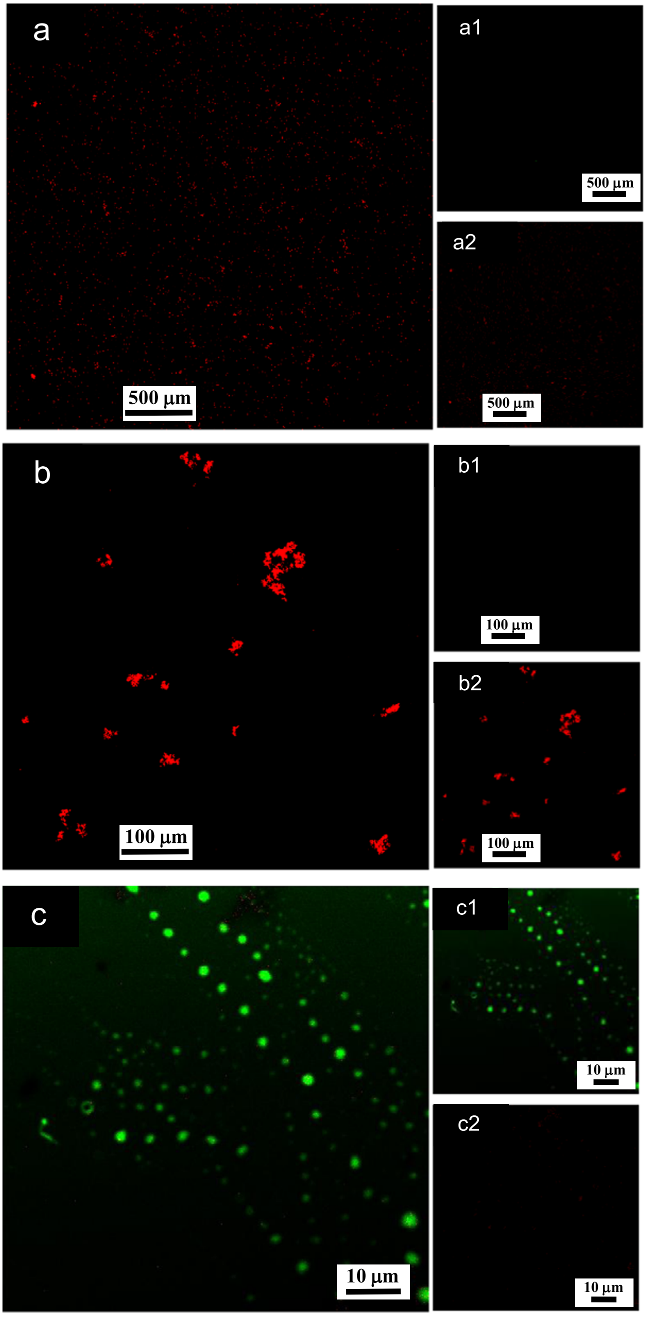

Fig. 12. LSCM images of aqueous dispersions (Sample (**B3**)) containing κ-carrageenan at a concentration of 0.095 g/L and surfactant at a concentration of 0.083 g/L. Sample (**B3**) was stained with acridine orange for which the surfactant and κ-carrageenan emissions correspond to 500–530 nm (green canal) for an excitation of 488 nm, and 570–620 nm (red canal) for an excitation of 561 nm, respectively. (a)–(c): LSCM green and red merged canals for both surfactant and κ-carrageenan emissions; (a1)–(c1): LSCM green canal corresponding to surfactant emission at 500–530 nm; (a2)–(c2): LSCM red canal corresponding to κ-carrageenan emission at 570–620 nm.

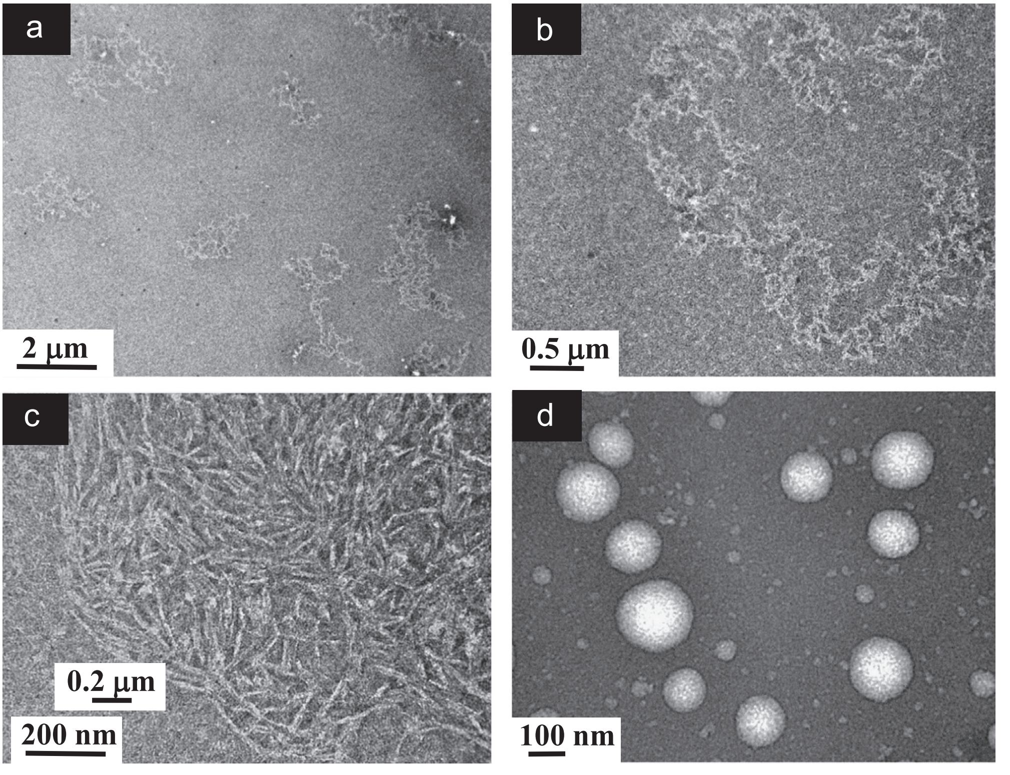

Fig. 13. TEM images of aqueous dispersions (Sample (**B3**)) containing κ-carrageenan at a concentration of 0.095 g/L and surfactant at a concentration of 0.083 g/L. (a): Global view showing a distribution of aggregates resulting from k-carrageenan along with spherical-liked particles; (b)–(c): Higher magnification views of an aggregate connected to a spherical-like particle; (c) Details of aggregates formed by rolled-up κ-carrageenan; (d): Details of spherical-liked particles.

2. Experimental design, materials and methods

Materials and Methods adopted LCSM and TEM experiments have been already described by us in our previously published article (http://dx.doi.org/10.1016/j.carbpol.2016.08.027) [1].

Acknowledgments

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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.2016.09.026.

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