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Polymer nanoparticles as surfactant carriers for enhanced oil recovery

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Nowadays, the focus of attention in the oil and gas industry has turned to the new discoveries of oil, such as the ones from pre-salt fields and also to new techniques for Enhanced Oil Recovery (EOR) in mature fields. It is well known that even after the application of primary and secondary recovery techniques a large portion of the original oil remains adhered to the reservoir rocks and is hardly produced. One of the best methods available to promote the production in mature fields is a chemical method of EOR which is based on surfactant solutions injections in the reservoir in order to decrease the interfacial tension of the water/oil systems. However, one of the major issues of this method is the great loss of surfactant molecules through adsorption on the reservoir rock's surface that occurs before the oil containing sites are reached. Therefore, it is an important challenge to develop a technology that would reduce the surfactant losses and still promote the oil displacement. In this context, cross-linked polystyrene nanoparticles have shown a promising ability to carry surfactants and deliver them only at the sites with oil. Their size would allow them to permeate through the reservoir pores (0.1-0.5 microns), and their chemical structure would allow them to swell when in contact with the oil releasing the surfactant at the water/oil interface, decreasing the interfacial tension and releasing the oil that is strongly adhered to the rock's pore surface.

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Development of high strength biofilm using sodium carboxy methyl cellulose and graphene oxide

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There is a great demand of high strength biomaterials in various kind of industries. In current studies we developed a strategy for fabricating high strength biofilm from sodium carboxy methyl cellulose and graphene oxide (GO) using simple and facile method. Well known hummer method was used to synthesize GO from graphite powder and a simple two step procedure was adopted to get biofilm having the required superb qualities. This film showed splendid mechanical properties having additional fire retardant behavior comparing with pure sodium carboxy methyl cellulose film. Film surface morphology was studied by scanning electron microscope (SEM) with energy dispersive spectroscopy (EDS) mode. Tensile test of film samples were performed using Universal Testing Machine equipped with 500N load cell at room temperature and an average humidity 20%. Fourier transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy were used to confirm crosslinking mechanism. The nanostructure of prepared biofilm clearly indicated layers under SEM. The stress–strain curve indicated five folds increase in the tensile strength with 0.7% GO and 0.09% borate in biofilm when compared with pure sodium carboxy methyl cellulose film. This modified biofilm showed fire-retardant behavior when exposed to flame, thus confirmed that compactly arranged graphene layers not only improve the mechanical properties but also improve fire resistivity of the biofilm. The simple and novel method used for the preparation of film provides a potential approach that may be utilized in the field of aerospace, tissue engineering and synthesizing flexible supercapacitor electrodes to be used in in different electronic devices.

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