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## Characterisation of the size and swelling kinetics of copolymer nano-spheres extracted from an emulsion

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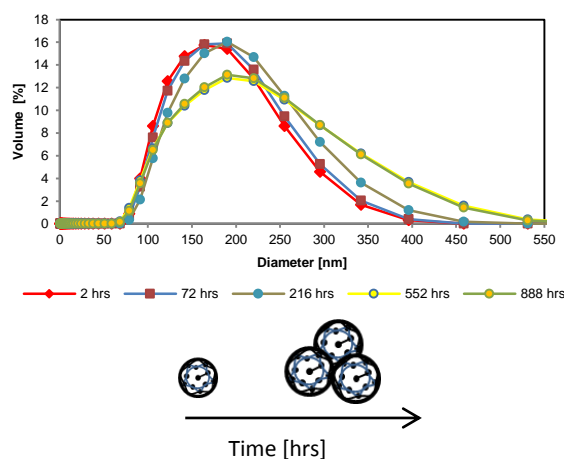
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### HIGHLIGHTS

- Extraction of the copolymer nano-spheres from the emulsion is possible with acetone and the following treatment with ultrasound.
- A procedure for the study of agglomeration and swelling rates separately with TEM was designed.
- Nano-spheres swell and agglomerate over time.
- Results of dynamic light scattering are similar to electron microscopy.

### GRAPHICAL ABSTRACT



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### ABSTRACT

The size distribution and swelling kinetics of copolymer nano-spheres extracted from an W/O emulsion was studied with dynamic light scattering (DLS) and transmission electron microscopy (TEM).

TEM results were compared against DLS results. It was demonstrated that the size distribution for agglomerates (clusters) of particles match well with the size distribution obtained from DLS. Hence, less time consuming DLS tests can be used for the estimation of the size of nano-spheres in the future.

Next, a novel procedure for the study of agglomeration and swelling rates separately with TEM was designed. The results of the study revealed that the spheres agglomerate and swell over time. The kinetics of the agglomeration is used for a population balance model to predict the size of spheres over time. This approach helps to understand how well the spheres can propagate in an oil reservoir over time.

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## 1. Introduction

The practical application of nano-spheres is broad. They can be used in enhanced oil recovery technologies

(Randy et al., 2015), drug-delivery systems (Farooqi, 2015) and templates for nanomaterials (Farooqi, 2015). In our work the nano-spheres are considered as a candidate for the improvement of oil recovery in heterogeneous reservoirs.

Usually, water is injected into the reservoir to maintain pressure and displace oil. However, the difference in the

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