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Electronic Supplementary Information for:

Influence of carbon quantum dots on the viscosity reduction of polyacrylamide solution

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The static position method is the most generally used method to decide the stability of nanofluids. The static position method allows nanofluids to stand in a container for a particular period, and the distance or colour difference in sedimentation between nanofluids was observed by the naked eye [1-4]. However, this method cannot evaluate the true stability of the composite suspensions. Therefore, in this study, the stability of nanofluids was determined using static and dynamic tests. The selected samples were evaluated via eye test investigation, turbiscan analysis, and zeta potential measurement. In the static position method, all samples remained standing for 10 days, and the stability difference between samples was observed by the naked eye. However, as shown in **Fig S1,** the differences were difficult to detect using naked eye observation. The sedimentation behaviour was monitored every 1 h for 24 h, backscattering intensity/transmission intensity profiles versus the height in the sample at different times were obtained. The backscattering profiles interpretation explained the changes in the backscattering light caused by the particle sedimentation within the sample cell. Over the period of time, the backscattering profiles vary with the height of the sample when sedimentation occurs. However, if the particle dispersion is stable, over the entire sample cell, no noticeable change in the backscattering profiles is observed with time.

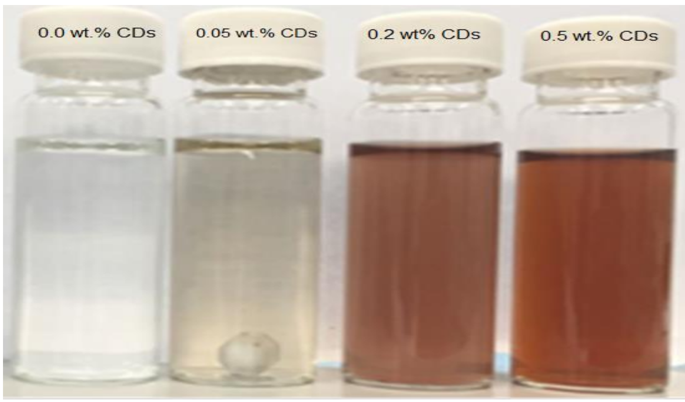


Figure S1. Static position stability test for the addition of different amounts of CQDs into PAM

In this study, the case of the suspension containing 0.05, 0.2 and 0.5 wt. % CQDs, with neat PAM sample as reference, shows a representative example of highly stable suspension (**Fig. 2b**). The results indicate that since there is no particle precipitation throughout the height of the container, therefore, no sedimentation takes place in all range of CQDs concentration. This improved stability is related to the variation of the surface charge of the particles. The state of the surface charge with the incorporated amount of CQDs were investigated by measuring zeta potential of PAM/CQDs composites at different temperatures, in addition to measuring the zeta potential of neat PAM and pure CQDs. The results in **Fig. 2a** indicate that, compared with the zeta potential of bare PAM and neat CQDs, the zeta potential of the composites is much stronger, indicating that improved dispersion stabilization is achieved.

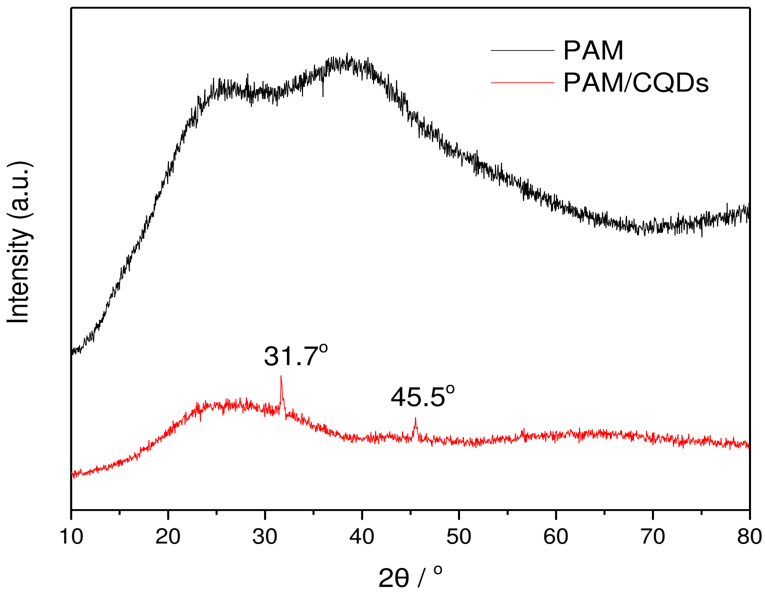
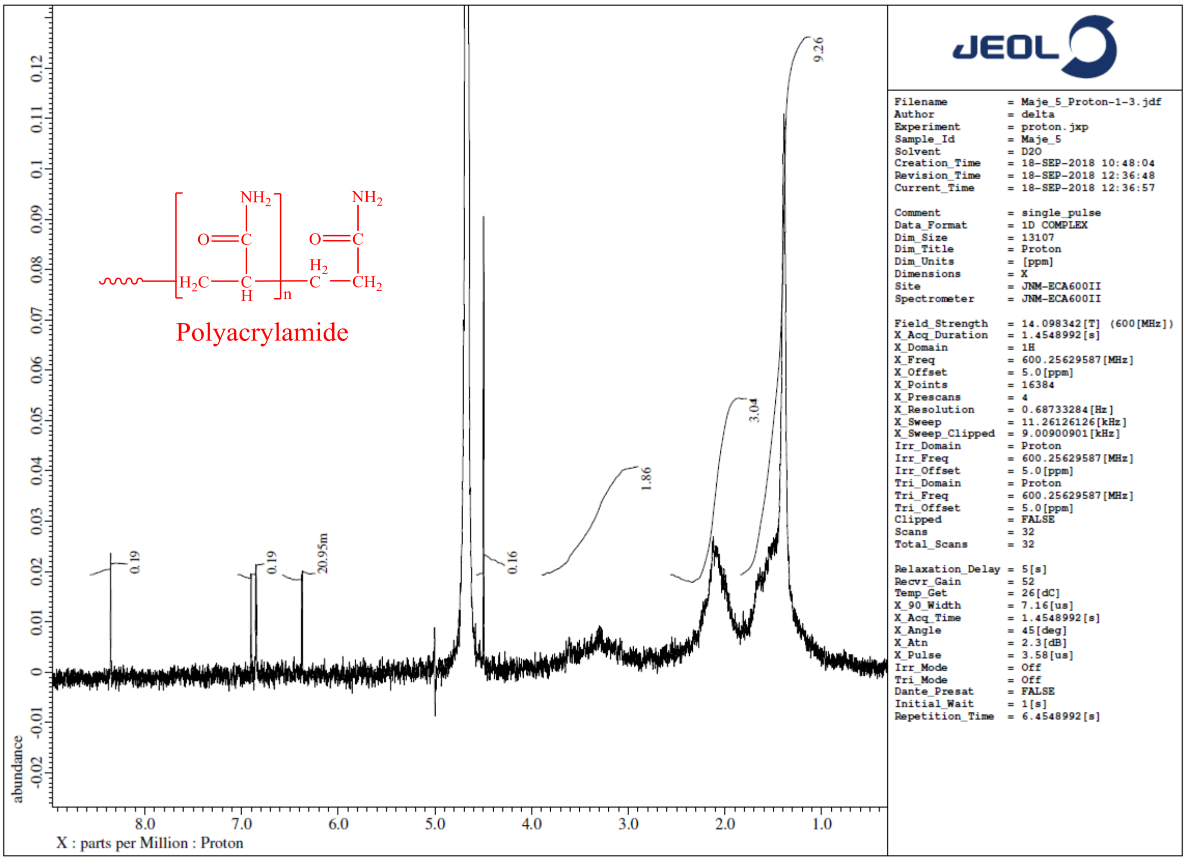


Figure S2. XRD profiles for PAM and PAM/CQDs composites



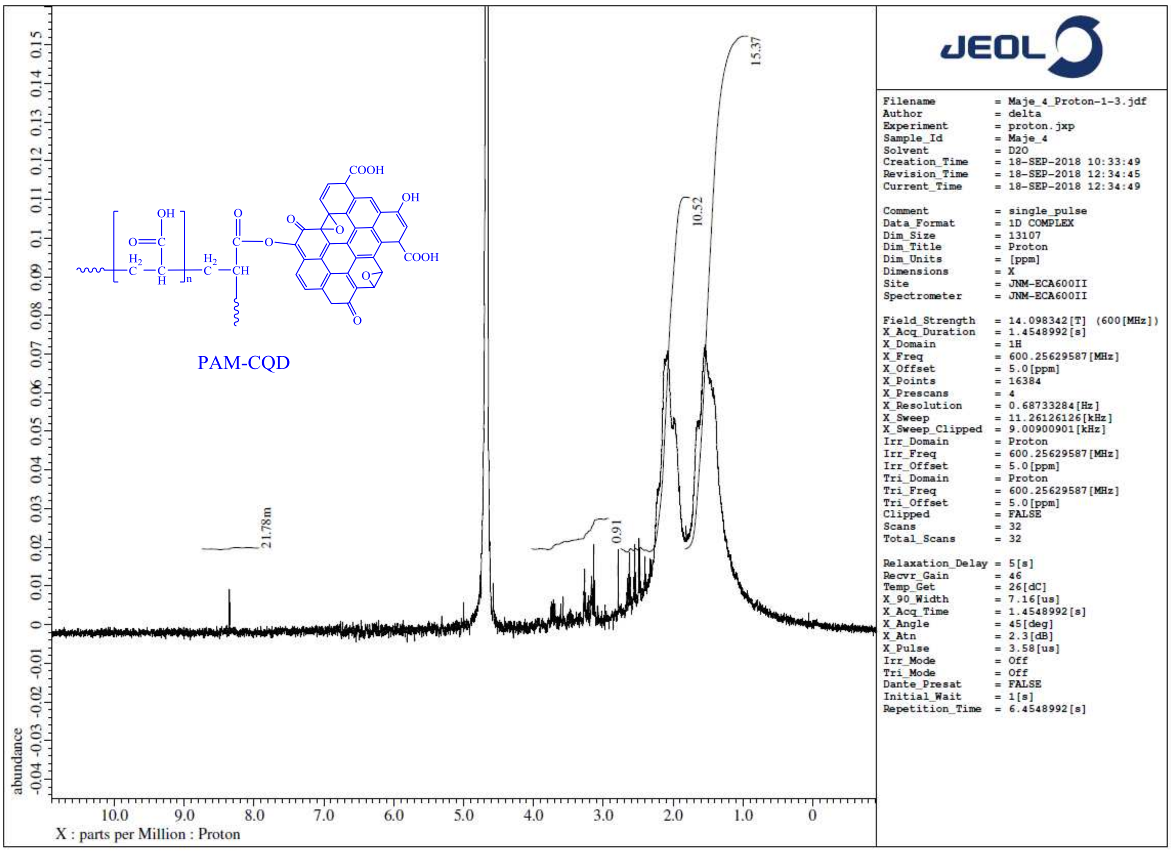


Figure S3. ^{1}H-NMR for (a) PAM and (b) PAM/CQDs composites

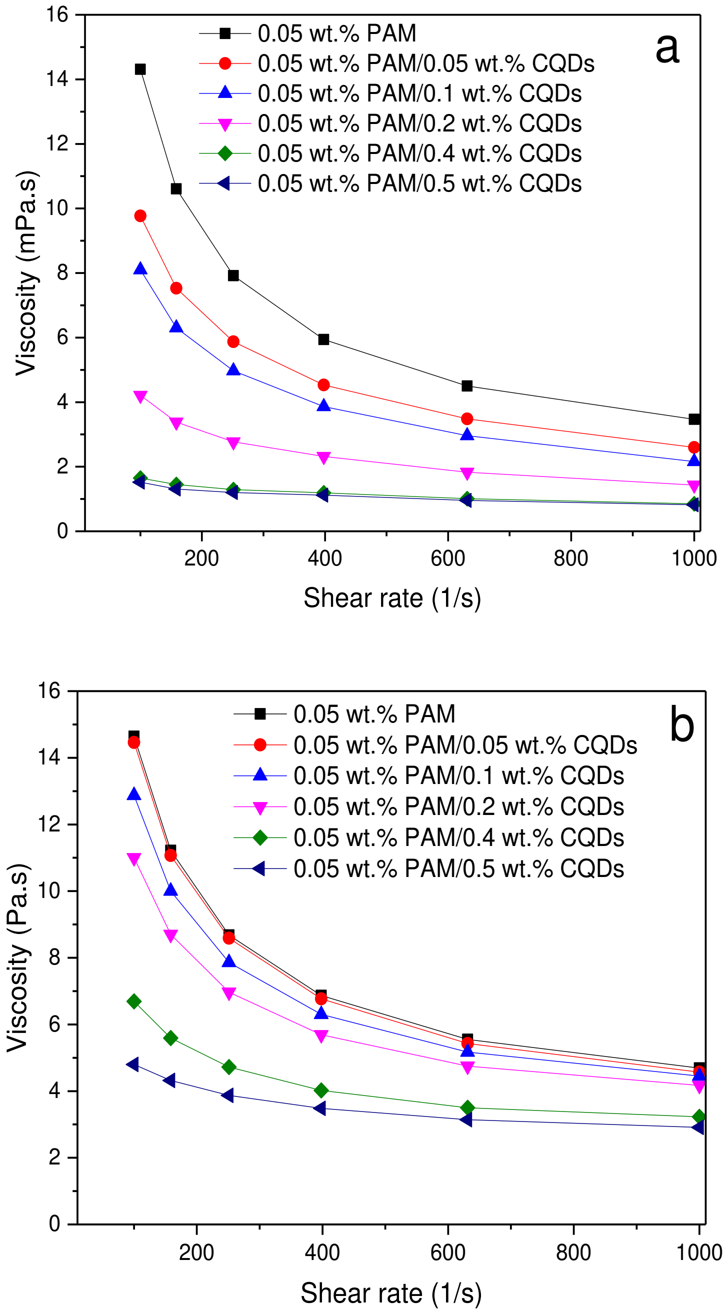


Figure S4. The dependence of viscosity for PAM/CQDs composite on shear rate with different loadings of the CQDs (a) T= 85 °C (b) T= 25 °C (shear rate 100-1000 s^{-1}).

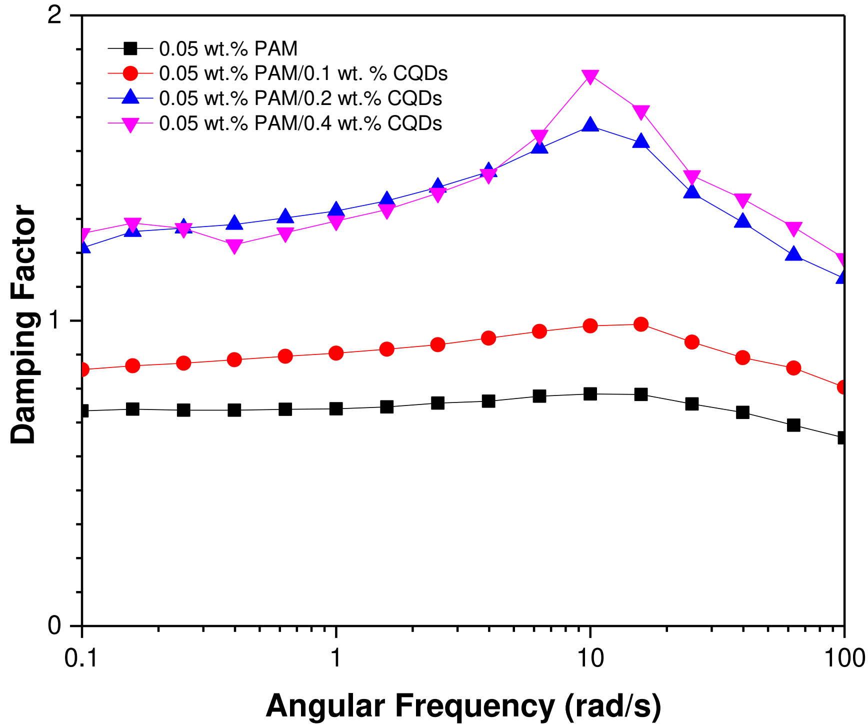


Figure S5. Plots of the damping factor of PAM and PAM, with different concentrations of the CQDs, as a function of angular frequency (ω).

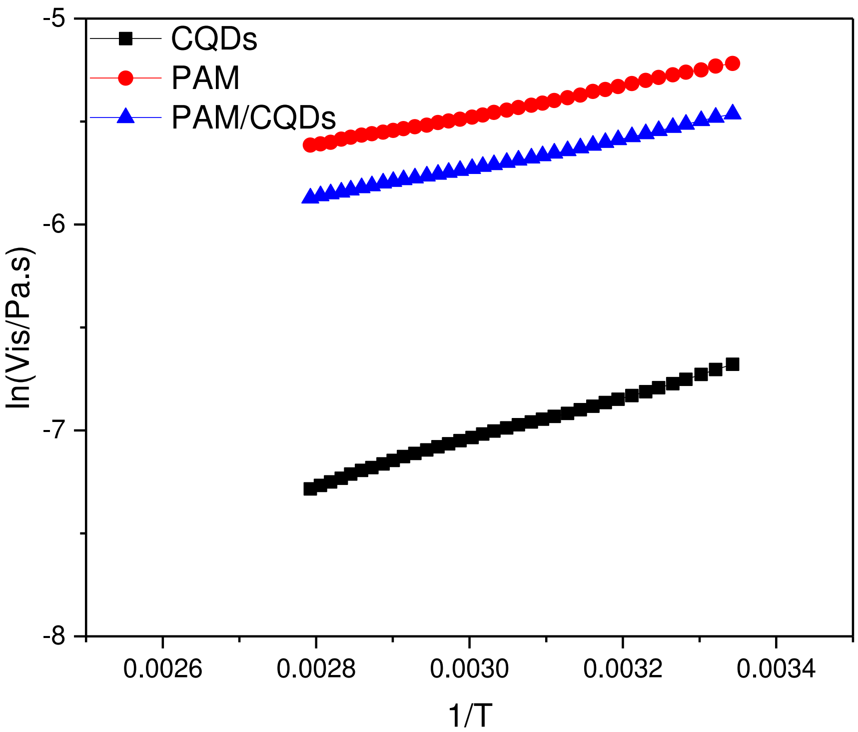


Figure S6. Plot of ln(Viscosity) vs 1/T, used in modelling the flow kinetics of PAM, CQDs and PAM/CQDs.

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