Graduate Student, Energy, Environment & Resource Sustainability

Preparation and Characterization of Fe_3O_4 nanoparticles and Its Application in Produced Water Treatment and Oil Recovery

Wamda Elhaj[1] ,PhD, Fares Al-Momani[1], PhD

[1]Department of Chemical Engineering, College of Engineering, Qatar University

ABSTRACT

Qatar is a major oil and gas producer country, and there are considerable amounts of oil were produced from oil fields need to be recovered.

Aims: Enhance recovery of oil from produced water using Fe_3O_4 magnetic nanoparticles as demulsifier for oil removal from produced water.

Results: Fe_3O_4 MNPs were prepared and their demulsification efficiencies were evaluated. Results showed that the application of these nanoparticles could significantly improve the efficiency of the demulsification process. Also, the MNPs were still effective after being recycled for 4 cycles and give high oil removal of 90%.
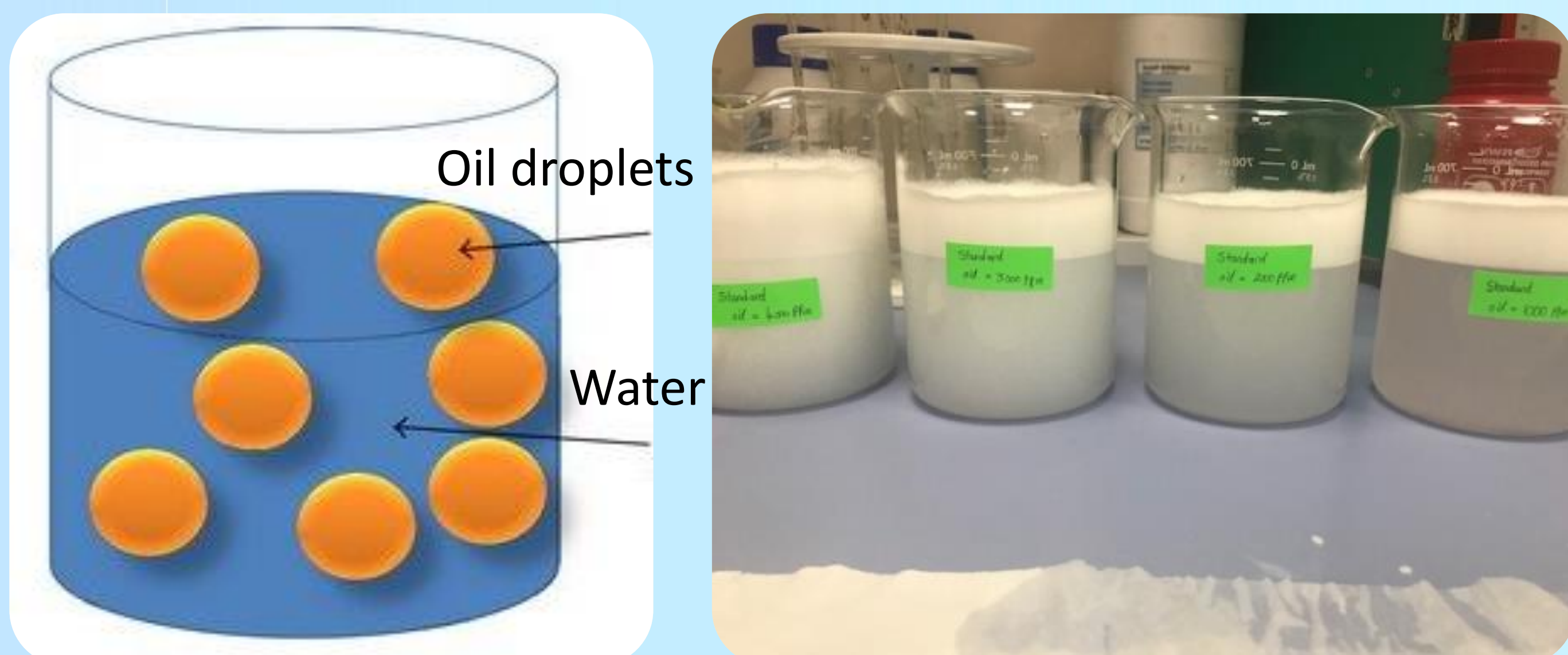
Figure 1. Oil In Water Emulsion

INTRODUCTION

Fe_3O_4 magnetic nanoparticles are used for their dispersibility in water and simple separation. When Fe_3O_4 MNPs are dispersed in the emulsion they attach to the oil/water interface. The oil droplets will be coated with the MNPs and then separated using an external magnet. The results of Fe_3O_4 MNPs demulsifiers showed high demulsification efficiency.

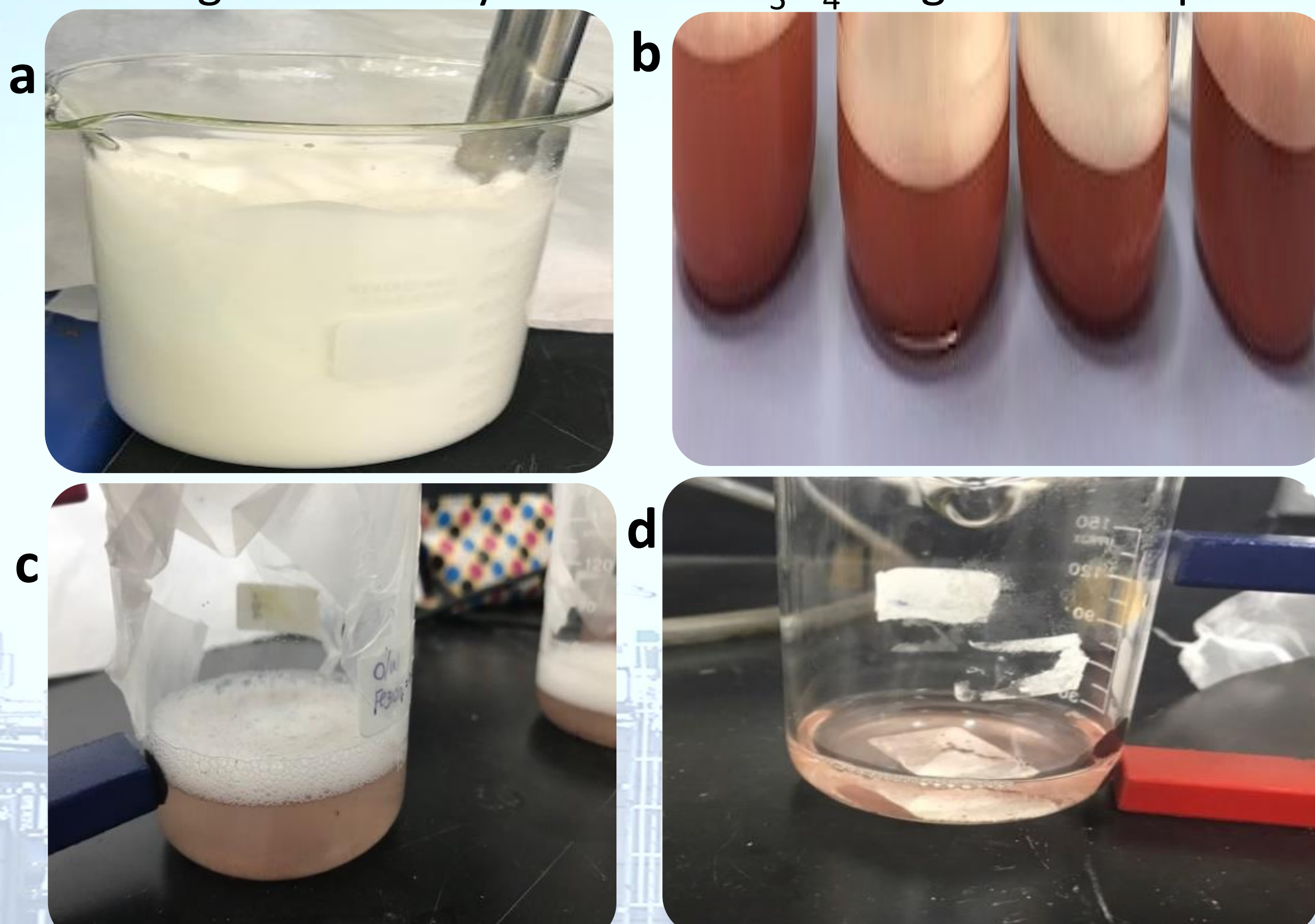Figure 2. The synthesized Fe_3O_4 magnetic nanoparticles

Figure 3. Demulsification Process: (a) Preparation of oil/water emulsion (b) Oil/water emulsion samples after the addition of the nanoparticles (c) Magnetic separation after 5 min using Fe_3O_4 (d) Magnetic separation after 8 min using Fe_3O_4
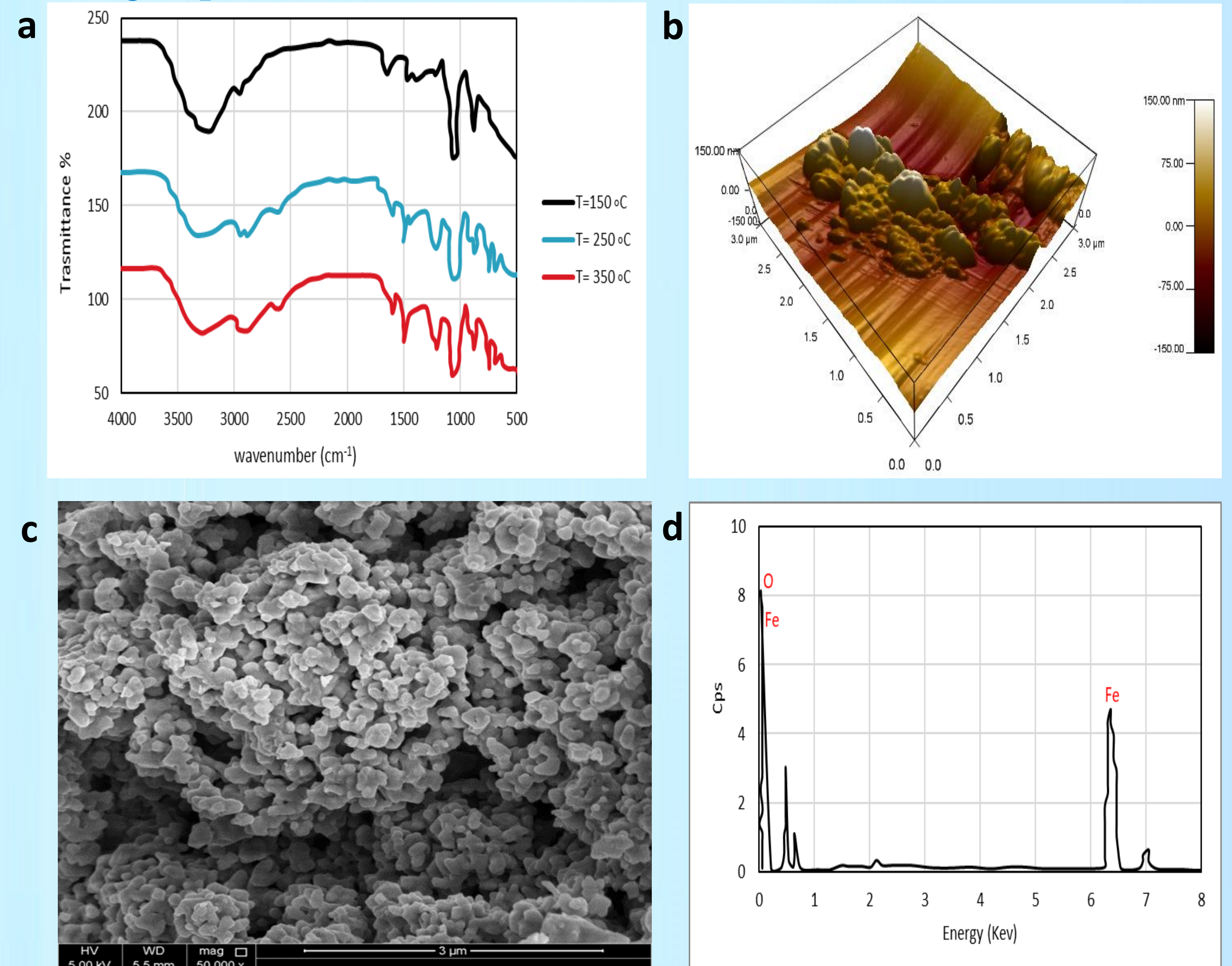
Fe_3O_4 MNPs CHARACTERIZATION

Figure 4. FTIR spectrum of Fe_3O_4 (b) Atomic Force Microscope (AFM) (d) SEM analysis (e) EDX analysis

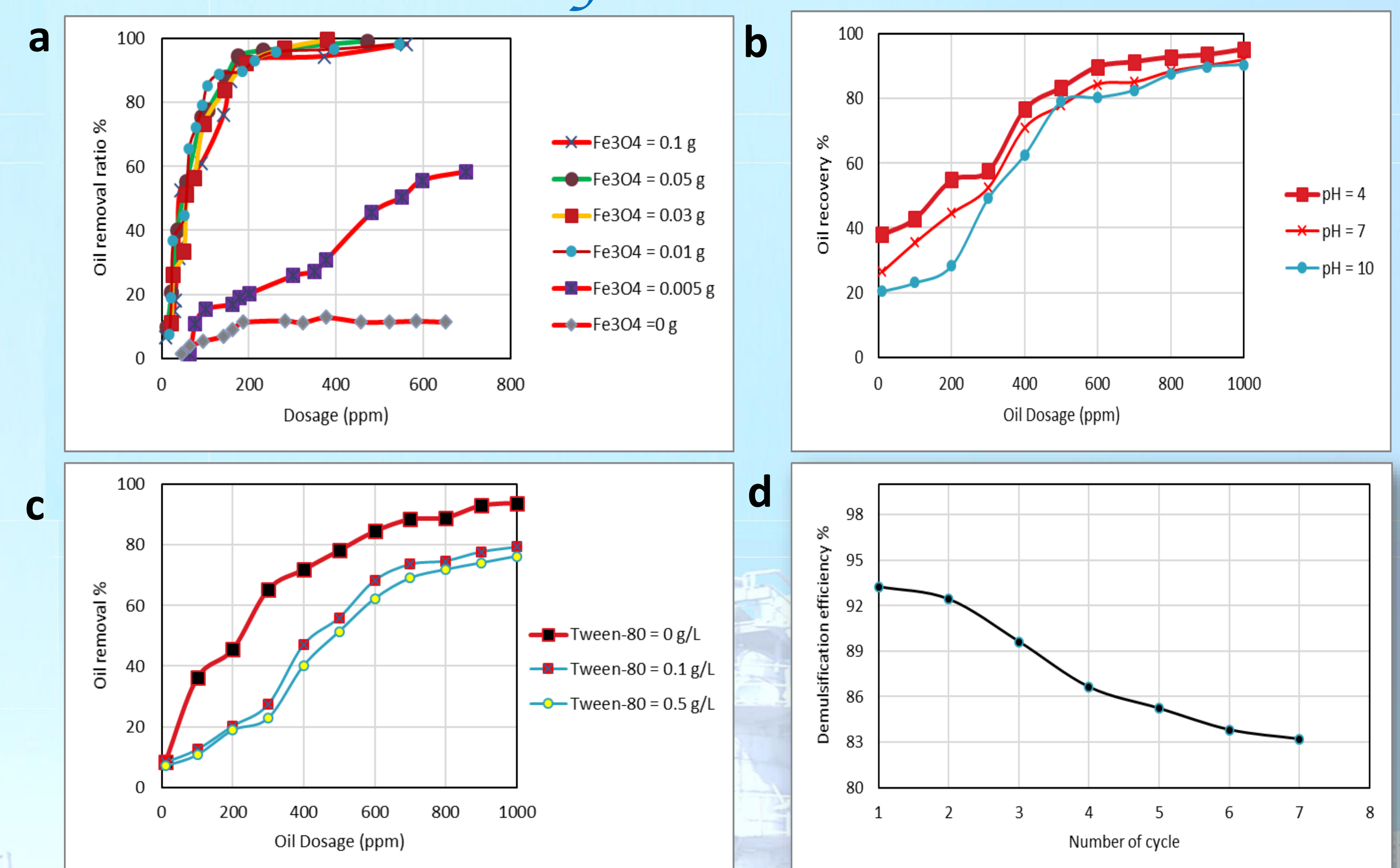## Demulsification RESULTS

Figure 5. (a) The Effect of different iron oxide MNPs amounts on the demulsification process (b) The Effect of different pH (c) The Effect of different surfactant concentrations (d) The recyclability of the MNPs at pH 4

CONCLUSION

- An innovative recycling process was developed for the separation of oil/water emulsion using Fe_3O_4 magnetic nanoparticles .
- The analysis used was successfully defined the morphologies molecular structure the size and roughness of the nanoparticles.
- Results showed that when the temperature changed different nanoparticles sizes were obtained.
- The nanoparticles showed significantly improve in the efficiency of the demulsification process.
- The prepared MNPs were still effective after being recycled for 4 cycles.