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ABSTRACT:

Adsorption Study of Surface Modification of Nanoparticles Using Polymer for Enhanced Oil Recovery

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Surface modification of nanoparticles through polymer adsorption is a widely adopted strategy to enhance the colloidal stability, dispersibility, and functional performance of metal oxide nanoparticles. In this study, zinc oxide (ZnO) and nickel oxide (NiO) nanoparticles (< 100 nm) were surface-modified using two hydrophilic polymers — polyacrylic acid (PAA) and polyacrylamide (PAM) — via a physical adsorption method at 100 °C. Four modified systems were produced: ZnO–PAA, ZnO–PAM, NiO–PAA, and NiO–PAM. The adsorption capacity was determined from the volume change of the polymer supernatant after centrifugation, with ZnO–PAM and NiO–PAM yielding higher adsorption (5.2 mg/g) compared to ZnO–PAA and NiO–PAA (4.6 mg/g). Fourier Transform Infrared (FTIR) spectroscopy confirmed successful polymer adsorption, evidenced by characteristic O–H, N–H, C=O, and COO[−] stretching bands in the 400–4000 cm^{−1} region. The results demonstrate that PAM exhibits relatively stronger adsorption onto both ZnO and NiO surfaces compared to PAA, suggesting stronger interactions between amide groups and metal oxide surfaces. This work provides fundamental insight into polymer–nanoparticle interactions relevant to applications in drug delivery, catalysis, and environmental remediation.

Keywords — Nanoparticles surface modification, Polymer adsorption, Zinc oxide (ZnO), Nickel oxide (NiO), Polyacrylic acid (PAA), Polyacrylamide (PAM), FTIR characterization, Adsorption capacity

References

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