# SUMMARY

Pollution by crude palm oil (CPO) can damage waters and aquatic ecosystems, necessitating effective treatment methods. Adsorption is an alternative option with many advantages due to its simple, economical, and environmentally friendly process. Silica from Lapindo mud has the potential to be used as an adsorbent, with a silica content of 47%. Furthermore, the use of Lapindo mud as a silica source is still rarely utilized, making its use highly promising. Silica modification was carried out using magnetite to facilitate adsorbent separation and CTAB as a template to ensure the adsorbent has the appropriate pore characteristics.

This research consisted of four stages: the first stage was the production of magnetite using the coprecipitation method. The second stage was the extraction of silica from Lapindo mud using acid leaching. The third stage was the synthesis of a silica coating on magnetite using the sol-gel method. The fourth stage was characterization and testing using Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscope-Energy (SEM-EDX), and Gas Sorption Analyzer (GSA).

The results of this study show the effect of variations in calcination temperature on the synthesis process and CTAB as a template. The success of the synthesis was confirmed by the appearance of vibrations of the Fe-O-Si group at a wavelength of 546 cm-1, vibrations of the Si-O-Si group at a wavelength of 440 cm-1 and vibrations of Si-OH at a wavelength of 975 cm-1. The results of the XRD analysis showed peaks in the planes (220), (311), (440) and (400). While using SEM-EDX analysis the percentage of Fe elements was 48.47% and Si was 1.26% with the image showing heterogeneity in size and a rough surface. The results of characterization using GSA obtained a surface area of 37.048 $m^2$/g, a pore volume of 0.321 $cm^3$/g and a pore diameter of 33.907 nm. The silica magnetite adsorbent follows a pseudo second-order kinetic equation and a Langmuir isotherm with an adsorption energy of 28.89 kJ/mol.