Iron oxide magnetic nano-particles (MNP) are of great interest in biomedical research because of its biocompatibility, biodegradability, and nontoxicity. In particular, iron oxide MNP in the form of crystalline magnetite (Fe$_3$O$_4$) attracted various biomedical applications such as drug delivery, magnetic resonance imaging (MRI) contrast enhancement, targeted tumor treatment etc. From a clinical point of view, it is desirable that the MNPs are neither too large nor too small because large MNPs will be filtered by the human spleen, and small MNPs will be removed by renal clearance.

X-ray diffraction (XRD) is ideal for the determination of the crystallite size of MNPs. If the MNPs are in the form of single crystals, the crystallite size should be identical to the particle size, which can be determined separately by small-angle x-ray scattering (SAXS). In this work, we conducted XRD on Fe$_3$O$_4$ powders and SAXS on the same Fe$_3$O$_4$ MNPs dispersed in hexane. The crystallite size determined from XRD and the particle size determined from SAXS were compared. The magnetization of the Fe$_3$O$_4$ MNPs as a function of applied magnetic field was measured on a Quantum Design Magnetic Property Measurement System (MPMS).