This study used NMR, a non-destructive, fast, and accurate method requiring small sample volumes, to analyze water uptake by silica gel. Hydrogen proton resonance, induced by a radio frequency pulse in a magnetic field, measures the transverse relaxation time (T2); longer T2 indicates greater water mobility.

A VTMR20-010V-I NMR instrument with specific parameters (e.g., 21 MHz RF frequency, CPMG sequence) was used. Silica gel samples were analyzed at 40°C and 85% relative humidity. Pre- and post-adsorption NMR signals were compared, integrating signal areas against T2 to determine water content changes. This data, combined with material quality changes, allowed deduction of the specific water adsorption reaction equation (detailed in a later section).