Effective magnetic moment method based on Curie-Weiss law

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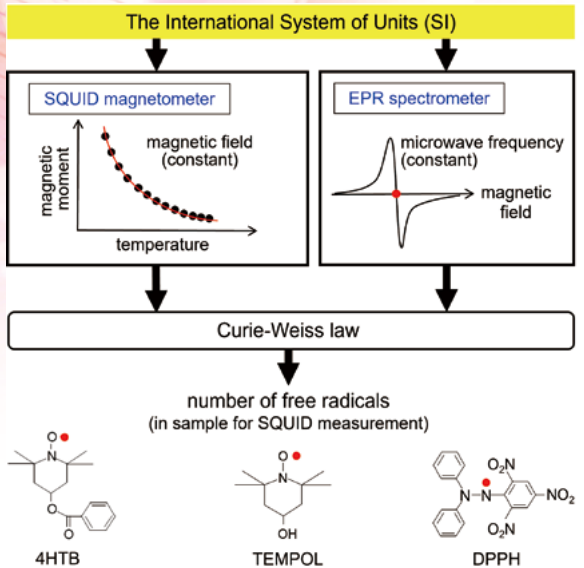
The “primary direct method for amount-of-substance” can directly obtain the amount of substance or amount of substance fraction based on the International System of Units (SI) without referring to any reference material. However, only three primary direct methods include gravimetry, coulometry, and freezing-point depression. This study proposed an “effective magnetic moment method” based on the Curie-Weiss law, which is related to the temperature variation of magnetism for a paramagnetic substance. The proposed method applies to a compound that includes an unpaired electron in a diamagnetic matrix and quantifies the number of free spins originating from the unpaired electrons. Therefore, this method emerges as a valuable tool for assessing the purity of rare-earth compounds, transition metal compounds, and organic free-radical compounds. As a practical case, the number of free radicals (free spins) included in the stable pure free radical reagent was accurately obtained by measuring the temperature dependence of the magnetic moment using a superconducting quantum interference device (SQUID) magnetometer and by measuring the resonant magnetic field when a microwave was irradiated, using an electron paramagnetic resonance (EPR) spectrometer. The purity of each reagent was evaluated depending on the number of free radicals.



Purity evaluation of organic free radical reagents by effective magnetic moment method

Reference: N. Matsumoto et al., *Anal. Chem.* **94**, 12595, 2022, DOI: 10.1021/acs.analchem.2c01005