

Development of Gd@C₆₀ Based MRI Contrast Enhancing Agents

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Recent reports on polyhydroxylated Gd@C₈₂ compounds have demonstrated the principle of using water-solubilized paramagnetic endohedral metallofullerenes as contrast enhancing agents for magnetic resonance imaging (MRI). Unfortunately, given the low abundance of the M@C₈₂ materials and the labor-intensive purification involved in generating pure samples, their prospects as pharmaceuticals with significant commercial impact may be limited. However, the potential pharmaceutical applications of the more abundant M@C₆₀ and related molecules have been overlooked until now. While these metallofullerenes are generally insoluble and air-sensitive, their production yields from the carbon arc technique can exceed soluble M@C₈₂ species by at least an order of magnitude. We will outline a new separation and derivatization process on Gd@C₆₀ and related molecules that allows for their use as MRI contrast enhancing agents. Spectroscopic and magnetic relaxivity characterization (showing relaxivities comparable to currently used Gd chelates) of these new water-soluble and air-stable endohedral metallofullerene materials will be discussed. Preliminary results indicate decreased intramolecular aggregation relative to the polyhydroxylated M@C₈₂ materials, important for the development of their medical applications. This first practical usage of M@C₆₀ compounds opens the door to increased study and applications development with this important but relatively unexplored class of endohedral metallofullerenes.