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Defect-free dendrimer synthesis through proportionate branching

Key Investigator
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Field
Radiology
Diagnostic

Technology
Dendrimer Synthesis

Advantages
Uniform dendrimer synthesis
Monodispersed
Defect-free

Status
Available for licensing

Patent Status
U.S. Patent 9,133,114

UMB Docket Reference
BY-2012-013

External Reference
J. Org. Chem. 77, 8879 (2012)

Summary
Dendrimers are nanoparticles of synthetic monomers with applications in commercial paints, blood substitutes, nanomaterials, sensor technology. Dendrimers are also building blocks for targeted drug or gene delivery. The dendrimers open architecture forms hollow cavities within the branches that can encapsulate molecules such as drugs or DNA. Until recently, dendrimer size has been limited by defects attributable to steric congestion between the branches.

Market
There is a growing interest in dendrimers for applications in chemistry, materials science, nanotechnology, and medicine. The dendrimers of the present invention are ideally suited for use in detection of nucleic acid sequences, antibodies, antigens, immune complexes, and pharmaceutical compounds. In Vivo and in vitro diagnostic procedures like radioimmunologic assay, electron microscopy, ELISA, X-ray imaging, and magnetic resonance imaging (MRI) would also benefit from the increased control demonstrated by the method.

Technology
Investigators at the University of Maryland have developed a method for synthesizing highly branched dendrimers that avoid the steric congestion caused by traditional dendrimer synthesis strategies.

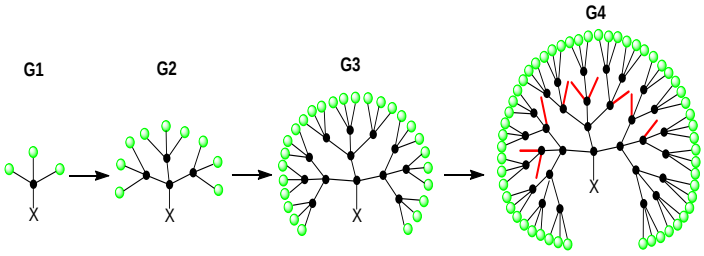

Figure 1: Steric hindrance in traditional synthesis strategies result in defects in the dendrimer.

The method enables the synthesis of defect-free macromolecules with a greater number of branches.

In traditional synthesis strategies, the dendrimer grows disproportionately – the number of branches grows exponentially but the length of the branches remains unchanged. The bioinspired strategy disclosed by the inventors allows for the proportionate synthesis of dendrimers. The strategy allows the branches to grow exponentially from the core to the periphery of the dendrimer and the length of the branches to grow exponentially from the periphery to the core.

The investigators demonstrated this approach by synthesizing two novel dendrimers amenable to 19F Magnetic Resonance Imaging (MRI).

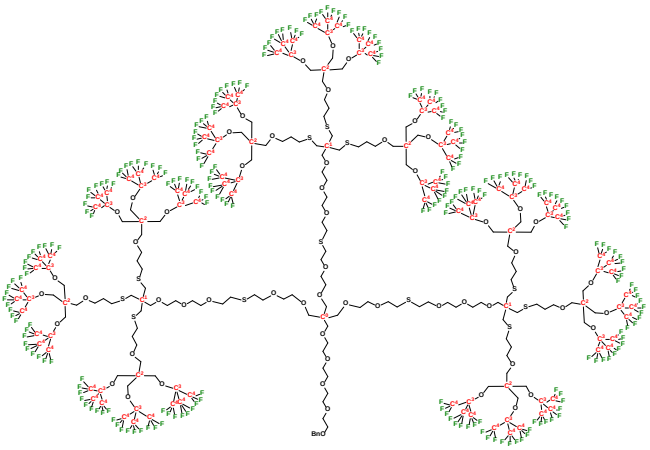

Figure 2: Dendrimer of the invention (MW 9.1 kDa)

Technology Status
Further research and development must be done into new applications for the described technology, and further development of the 19F MRI fluorinated dendrons is required.

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