A green and efficient free radical initiator system for producing hydrogels

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Unmet Need

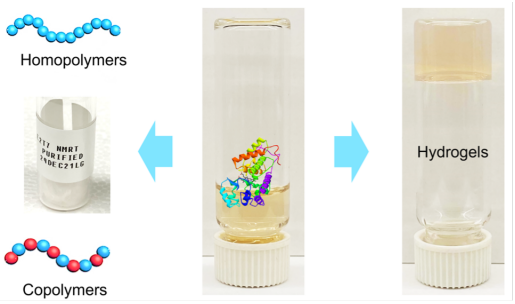
Hydrogels are heavily employed in agriculture, commercial wound dressings, and hygienic products, with more recent development in biomedical applications, including drug delivery, bioelectronics, bioimaging, and tissue engineering. Free radical polymerization is one of the most commonly used methods to manufacture hydrogels. However, the generation of initiating radicals for this process typically requires either expensive radiation equipment or toxic chemicals that must be removed from the hydrogels for many potential applications. There is a need for mild, efficient, eco-friendly methods to create polymers and hydrogels for applications including biomedical and healthcare.

Technology

Inventors at Duke have developed a method for producing hydrogels using free radical polymerization that is intended to reduce the number of steps and costs required for manufacturing. Specifically, an *N*-hydroxyimide compound (ES1) enables a horseradish peroxidase-mediated radical initiating system to produce polymeric hydrogels and avoids the use of conventional beta-diketones that pose toxicity concerns. The inventors have demonstrated this process with a variety of monomers (e.g., DMAA, NVP, NIPAM, PEGMA, gelatin methacryloyl, and acryloylated proteins) and found that polymerization is successful at mild temperatures (room temperature to 37 °C) across a wide pH range (2.3 – 7.5) with a relatively short induction period (as short as 1 min). Additionally, they have effectively incorporated inorganic and metallic nanoparticles (e.g., gold and silica nanoparticles) into polymer networks to produce functional nanocomposite hydrogels.

Advantages

- Creates a hydrogel within minutes under mild conditions
- Avoids the need for expensive equipment or toxic reagents associated with other free radical polymerization methods
- Likely does not require the need to remove the initiator system from the hydrogel before applications



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Inventor(s)

- Su, Teng
- Joseph, Neica
- West, Jennifer

Links

- From the lab of Dr. Teng Su

College

Pratt School of Engineering

For more information please contact

Mullins, Alexandria "Alex"
alex.mullins@duke.edu

- A versatile process that can be used to create hydrogels from a variety of monomers for applications in many industries, including biomedical, automotive, chemical, solid-state organic electronics, agriculture, forestry, and textile
- Shows high monomer conversion (> 95%)

Publications

- Novel enzyme mediated ternary radical initiating system for producing hydrogels (2021 Spring ACS Meeting Graphical Abstract from Polymer Session)