Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

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Inventors

Kaushal Rege
Taraka Sai Pavan Grandhi
Thrimoorthy Potta

Contact

Jovan Heusser
jovan.heusser@skysonginnovations.com

Aminoglycoside-based Resins and Their Applications

Aminoglycoside antibiotics are known to prevent growth of gram-negative bacteria by inhibiting protein synthesis. Aminoglycosides possess biocompatible sugar groups as well as multiple amines in the same molecule. Their tenability and natural affinity towards nucleic acids makes them excellent candidates for generating diverse resins for multiple applications from biomaterials to protein and nucleic acid biotechnology.

Researchers at Arizona State University have developed novel crosslinked aminoglycoside-based resins which can be developed into multiple different architectures (microbeads, monolithic columns, macroporous hydrogel substrates, etc.) depending on the intended application. Multiple ligands can be attached to the resins to improve their nucleic acid binding capabilities. An abundant presence of easily conjugable groups make the resin highly desirable for further conjugations and modifications. Further, these resins were used to create tunable dormant 3D tumor spheroids for studying and developing therapeutics to dormant tumors in remission, which are known to be resistant to convention chemotherapeutics.

These microbeads and macroporous gels hold great promise in a variety of applications from pDNA purification to whole mammalian cell lysis for on-chip PCR reactions to point of care diagnostics. They can also be used for bone tissue engineering, studying cancer cells in 3D models, tissue welding and regenerative medicine.

Potential Applications

- pDNA purification
- Bone trabecular mimetics
  - The gels can be strengthened with reinforcing agents such as carbon nanotubes, gold nanorods, hydroxyapatetite, etc.
- Creating 3D in-vitro models for cell culture/tumor dormancy
  - Drug screening and discovery
  - Studying cancer cells (relapse, resistance, micrometastasis, etc.)
- Stem cell differentiation substrates
- Tissue welding constructs
- Regenerative medicine
- On-chip PCR reactions
- Point-of-care diagnostics

Benefits and Advantages

- Highly cationic to bind very high amounts of pDNA/cargo

- pDNA binding capacity of ~6 mg of pDNA/mL of the resin
- Multiple conjugable sites for further modifications
- Chemotherapeutic drugs to bind pDNA via electrostatic and hydrophobic interactions
- This platform allows for isolation and separation of highly aggressive forms of celcer cells from the heterogeneous population

For more information about the inventor(s) and their research, please see Dr. Rege's directory webpageDr. Rege's laboratory webpage