Jožef Stefan Institute, Ljubljana, Slovenia

TECHNOLOGY OFFER

DISRUPTION OF BACTERIAL BIOFILMS BY MAGNETIC NANOCHAINS

Fields of use

Medical prevention of infections (skin, endodontics, periodontitis, endocarditis, osteoarticular biofilms)

Decontamination of medical devices (prostheses, catheters, orthopedic implants, heart calves, dental substitutes)

Cleaning of medical instruments (dental water lines, endoscope channels, drip irrigation systems)

Current state of technology

TRL3 (experimental proof-of-concept)

Next steps

Technology validation/ optimization in the lab

Type of cooperation

Technical cooperation agreement
Joint venture agreement
Licensing IP rights

Partners sought

Pharmaceutical companies
Medical device manufacturers

Intellectual property

Patent application no. EP23307039.0 filed in November 2023

Developed by

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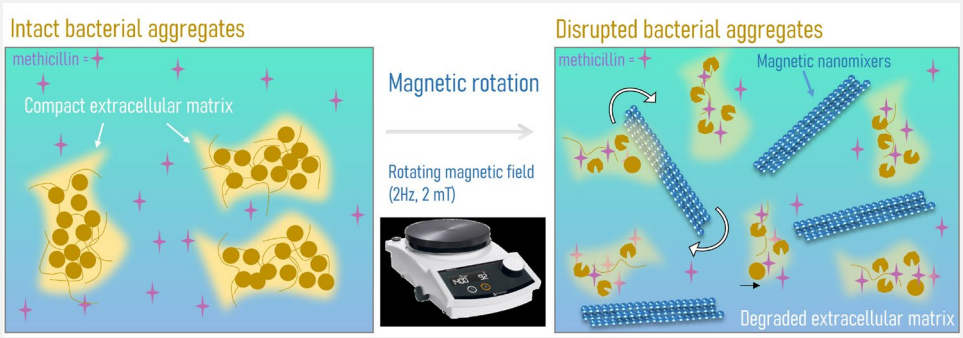
Antimicrobial resistance is a critical global public health threat and tough scientific and developmental challenge. Antibiotic-resistant infections cause millions of deaths worldwide. As bacteria develop resistance to antibiotics, the burden on global health intensifies, leading to untreatable infections, prolonged illnesses, and a looming crisis where routine medical procedures and surgeries become perilously risky. Biofilms significantly contribute to the failure of antibiotic therapies, making it imperative to target and eradicate biofilms to combat antibiotic resistance effectively.

Our technology

This invention encompasses a method for biofilm eradication using propelling highly magneto-responsive anisotropic iron oxide nanochains as nanomixers, activated by a classical low frequency magnetic stirrer applying low intensity rotating magnetic fields. The method enables localized disintegration of the biofilm, enhances penetration, and thus improves the efficacy of antibiotic agents. Nanochains effectively disrupt the biofilm and sensitize bacteria to antibiotics.



Nanochains activated by a rotating magnetic field in presence of an antibiotic (e.g. methicillin) kill more than 99.99% (= 4 log reduction) of methicillin-resistant biofilm-forming bacteria.

Main advantages

- Biofilm disruption
- Sensitization of bacteria to existing antibiotics
- Biocompatible and non-toxic / safe to mammalian cells

Potential applications

Tissues treatment

- Skin infections: chronic wounds (diabetic foot wounds), traumatic wounds, ulcers
- Mouth: dental substitutes and devices (small tooth glass devices), endodontics, periodontitis
- Tissues/organ infections endocarditis, osteoarticular biofilms

Disinfection

- Reusable medical devices: endoscope and other diagnostic probes, dialysis catheter
- Implantable medical devices: prostheses (orthopedic implants, prosthetic joints, heart valves)