Development of Polymeric Scaffolds for Regenerative Medicine

Keywords : scaffold, biomaterials, biomimetic materials, composite materials, tissue regeneration, cancer therapy

Guoping Chen
Biomaterials Field / Tissue Regeneration Materials Group
Guoping.CHEN@nims.go.jp | http://www.nims.go.jp/eng/research/group/tissue-regeneration-materials/index.html

Background

- Scaffolds are necessary for regeneration of large tissues.
- Controlling of cell proliferation and differentiation is important.
- Preparation of biomimetic materials is an attractive strategy.

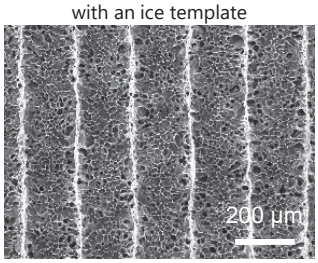
Aim

- Preparation of scaffolds with controlled pore structures and composite components.
- Preparation of polymeric scaffolds to promote tissue regeneration.
- Preparation of porous biomaterials with multi-functions.

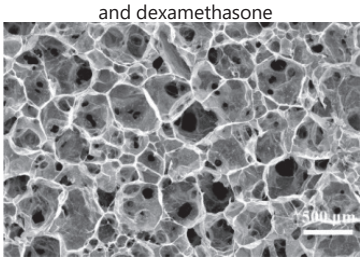
Advanced Research Topics

Porous scaffolds with open surface pores, interconnected bulk pores and micropatterned pore structures were prepared by using ice templates. Composite scaffolds of biodegradable polymers and bioactive molecules such as cell growth factors and dexamethasone were prepared. The scaffolds can be used for tissue engineering of skin, cartilage, bone and muscle and treatment of various diseases and defects.

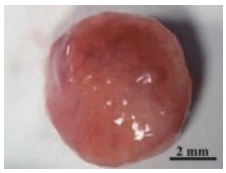
Microgrooved scaffolds prepared with an ice template



Composite scaffolds of collagen and dexamethasone

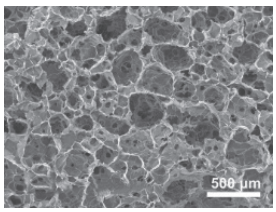


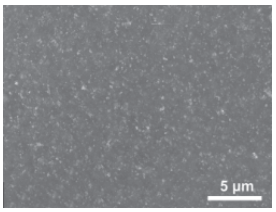
Regenerated bone tissue



Composite scaffolds of biodegradable polymers and nanoparticles such as magnetic iron oxide and gold nanoparticles were prepared by incorporating nanoparticles in the matrices of scaffolds. The composite scaffolds can be used for photothermal therapy of cancer and tissue regeneration.

Composite scaffold of gelatin and iron oxide.





Magnification of pore surface

Publications

- Acta Biomaterialia. 67, 341-353 (2018).
- Tissue Engineering, Part C: Methods, 23, 367-376 (2017).
- Journal of Materials Chemistry B, 5, 245-253 (2017).

Summary

- Promotion of tissue regeneration
- Regulation of stem cell differentiation
- Killing of cancer cells
- Reconstruction of disease model tissues

Research outcome

- Scaffolds for tissue regeneration
- Biomaterials for cancer therapy
- Biomaterials for surgical operation and wound dressing
- Scaffolds for reconstruction of disease model