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Education/Career:

2021-present	Specially Appointed Professor, Osaka University
2021-present	Emeritus Professor, The University of Tokyo
2000-2021	Professor, The University of Tokyo
1998-2000	Associate Professor, The University of Tokyo
1991-1998	Associate Professor, Tokyo Medical and Dental University
1987-1990	Assistant Professor, Tokyo Medical and Dental University
1984-1986	Research Associate, Sagami Chemical Research Center
1984	Doctor of Engineering (Applied Chemistry), Waseda University

Research Interests:
Polymer Chemistry, Biomaterials Science and Engineering, Biomimetic Science

Representative Publications:

1 Ishihara K, Shi X, Fukazawa K, Yamaoka T, Yao G, Wu JY. Biomimetic-engineered silicone hydrogel contact lens materials, *ACS Appl Bio Mater*. 2023;**6**:3600-3616
2 Ishihara K. Biomimetic materials based on zwitterionic polymers toward human-friendly medical devices, *Sci Technol Adv Mater.* 2022;**23**(1):498-524.
3 Ishihara K, Fukazawa K. Cell-membrane-inspired polymers for constructing biointerfaces with efficient molecular recognition. *J Mater Chem B*. 2022;**10**(18):3397-3419.
4 Ishihara K, Kaneyasu M, Fukazawa K, Zhang R, Teramura Y. Induction of mesenchymal stem cell differentiation by co-culturing with mature cells in double-layered 2-methacryloyloxyethyl phosphorylcholine polymer hydrogel matrices. *J Mater Chem B*. 2022;**10**(14):2561-2569.
5 Ishihara K, Narita Y, Teramura Y, Fukazawa K. Preparation of magnetic hydrogel microparticles with cationic surfaces and their cell-assembling performance. *ACS Biomater Sci Eng.* 2021;**7**(11):5107-5117.
6 Ishihara K, Abe M, Fukazawa K, Konno T. Control of cell-substrate binding related to cell proliferation cycle status using a cytocompatible phospholipid polymer bearing phenylboronic acid groups. *Macromol Biosci.* 2021;**21**:2000341.
7 Ishihara K, Oda H, Konno T. Spontaneously and reversibly forming phospholipid polymer hydrogels as a matrix for cell engineering. *Biomaterials.* 2020;**230**:119628.
8 Ishihara K. Blood-compatible surfaces with phosphorylcholine-based polymers for cardiovascular medical devices. *Langmuir*. 2019;**35**(5):1778-1787.
9 Ishihara K. Revolutionary advances in 2-methacryloyloxyethyl phosphorylcholine polymers as biomaterials. *J Biomed Mater Res A*. 2019;**107**(5):933-943.
10 Ishihara K, Mu M, Konno T, Inoue Y, Fukazawa K. The unique hydration state of poly(2-methacryloyloxyethyl phosphorylcholine). *J Biomater Sci Polym Ed*. 2017;**28**(10-12):884-899.

Biomimetic Contact Lens Materials Using MPC polymers

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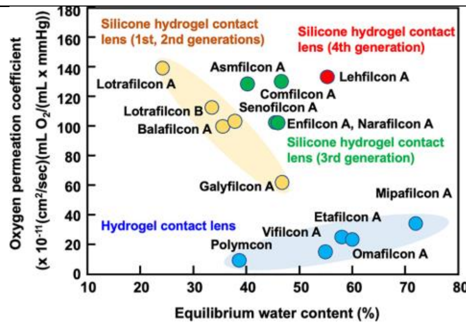
Contact lenses are one of the most successful applications of polymer biomaterials. The properties of the polymers used in the manufacture of contact lenses play an important role in determining the functionality of contact lenses. Specifically, the mechanical properties, optical properties, biocompatibility, and antifouling properties of these materials allow lenses to be comfortable during wear, including long-term wear. Advances in materials have addressed challenges such as the oxygen permeability and biocompatibility of lenses and their improved overall comfort. Soft contact lens materials based on 2-hydroxyethyl methacrylate (HEMA) could open one-day single-use contact lens technologies. To improve the water content of the HEMA-based hydrogel, other hydrophilic monomers are incorporated, Among these monomers, 2-methcryloyloxyethyl phosphorylcholine (MPC) is a significant monomer to make good wetting and antifouling properties. So, the contact lens materials have been commercialized as Omafilcon A(Proclear®). Development of long-term wearing of the contact lenses, silicone hydrogel is widely used as a contact lens material due to its excellent oxygen permeability. Good lens functionality can also reduce surface accumulations of lipid and protein deposits and infections caused by bacterial adhesion to the lens surface. Very recently, new silicone hydrogel contact lenses with a poly(MPC) layer on the surface have been commercialized (Lefilcon A: Total 30®). In this lecture, I will review how the design and properties of polymers used to manufacture contact lenses account for the lenses high performance.

Result 1

Omafilcon A is a copolymer of HEMA, MPC and small amount of cross-linker. Water content of the contact lens is 60%. This contact lens material is recognized by the FDA as effective for patients with dry eye syndrome because of its good moisture retention properties. However, the oxygen permeability of the lenses is dependent on the water content, which is assumed to be used for one day.



Result 2

Lefilcon A has improved the of silicone hydrogel lenses by a poly(MPC) layer on the surface. Despite its 55% water content, its oxygen permeability is enough high. In addition, lipid adsorption (left figure) and bacterial adhesion on the surface are effectively suppressed, making it possible to wear the contact lenses for a long period of time