Appendix 2

# Abstract of Thesis

| Report number | ☐Ph.D. obtained through coursework and thesis<br>No.<br>☐Ph.D. obtained by research and thesis only<br>No. | Name | 趙 雨濛 |
|---|---|---|---|
| Title of the thesis | Preparation of biocompatible surface using phospholipid analogue polymer | | |


Biocompatibility is crucial for medical devices, implants, and drugs, and can be affected by surface characteristics, with protein adsorption playing a key role. 2-methylacryloxyethyl phosphocholine (MPC) is a typical zwitterionic monomer containing cationic and anionic groups. MPC can form a hydration layer, resist the adsorption of non-specific proteins, and effectively maintain the natural conformation of proteins, which has been widely used. However, the environment inside the body is normally in the neutral range, but it is known that the local environment can be below pH 4 and in some cases under pH 3 due to cancer and inflammation, etc. When pH shifts from alkaline to neutral, fibrinogen uptake by PC group membranes increases by 40% due to partial protonation of the PC on the surface, while PC group materials are positively charged below pH 4. In general, positively charged surfaces are generally less biocompatible, as they do not inhibit the adsorption of proteins and other clot-forming substances.

In our previous report, we prepared a novel zwitterionic monomer 2-methacryloyloxyethyl choline phosphate(MCP), which has a polar group structure that is opposite to that of MPC. Unlike conventional zwitterions, the CP group has a terminal phosphate group and two desorption protons, which gives it different properties and the ability to inhibit protein adsorption at different pH ranges. In this work, we used the MCP monomer with different surface modification methods to form non-fouling surfaces. In this experiment, the surface of the material was modified with MCP using two methods: grafting from method and grafting onto method. The biocompatibility of the modified surface was then evaluated and compared with that of the MPC-modified surface.

In the grafting from method, MCP was used to modify the glass surface via surface-initiated activators regenerated by electron transfer atom transfer radical polymerization (SI-ARGET-ATRP) to form the polymer brush on the glass surface. MPC also used the same preparation method to modify the glass surface as a comparison group. The surface hydrophilicity and non-fouling property were measured in different pH ranges. The results show that the MCP-modified glass surface has the lowest water contact angle and can maintain a high hydrophilicity under acidic conditions, while the MPC-modified surface decreases hydrophilicity under acidic conditions. The protein adsorption test for non-fouling property also gave the similar result. Both MCP and MPC modified surfaces exhibit low protein adsorption level in the neutral environment. However, MPC showed a significant increase in protein adsorption in acidic environments, while MCP was still effective in avoiding protein adsorption. This indicates that MCP can be applied in a wider pH range than MPC.

In the grafting onto method, MCP was also used to prepare block copolymers with butyl methacrylate (BMA), and p (MCP-co-BMA) copolymer modified polypropylene (PP) films were prepared by hydrophobic interaction between the BMA in the copolymer chain and PP film.


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The copolymer was prepared in different ratios of the MCP and BMA fractions to find a suitable ratio that would maintain both anchoring stability and biocompatibility. The durability test results showed that when the chain length of BMA increased, the stability of the anchoring also increased. But at the same time, the protein adsorption test showed the biocompatibility decreased significantly. While the ratio between MCP and BMA is 3 to 7, the copolymer coating can remain stable and resist protein adsorption.