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A novel preparation for PVA/ L-Histidine/AgNPs membrane and its antibacterial property

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† Electronic supplementary information (ESI) available.

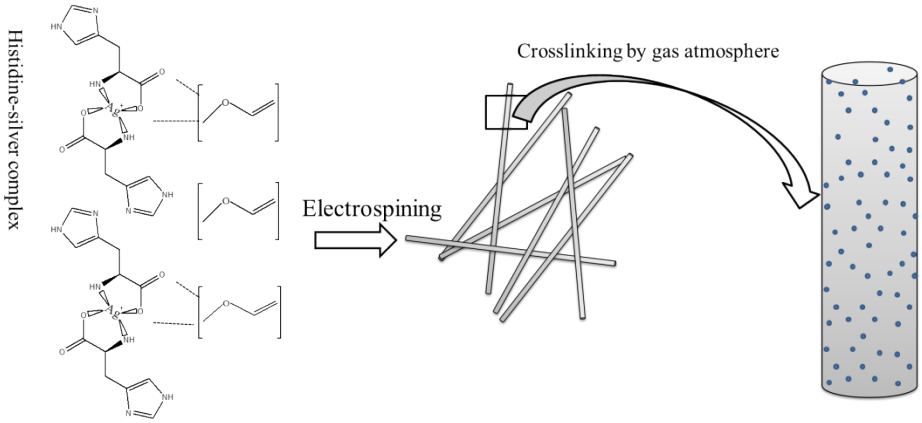

Figure S1: the process of preparation for PVA/L-histidine/AgNPs membrane

Firstly, the L-histidine would combine with silver ions to form six coordinate complexes; Generally speaking, the coordination of the amino acid to silver (I) ion seems to occur through the amino-group or carboxy group, forming two or four coordinate complexes[1]. However, there is imidazole group for L-histidine, which contains a three-stage nitrogen atom which has an unshared-pair electron, thus, it easily reacts with silver ions and forms six coordinate complexes[2]. Secondly, the two solutions were added into the needle of electrospinning, then, adjusting the parameters for producing the composite fibers. Finally, the membrane was put into the space which is full of mixed gas of hydrogen chloride and glutaraldehyde for crosslinking. In this section, the glutaraldehyde not only refers as crosslinking agent but also the reducing agent, which could reduce the silver ions to silver particles.[3]

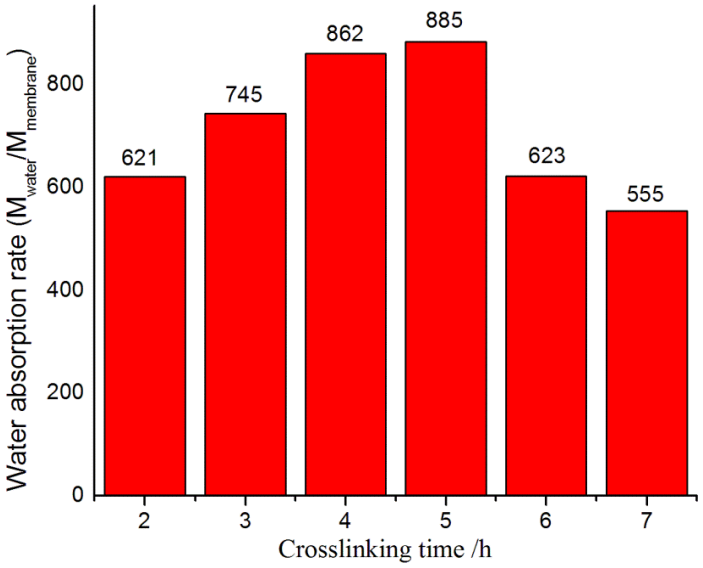

Figure S2: the effect of PVA nanofibrous membranes cross-linked with different time to water absorbent rate (M_{water}=M-$M_{membrane}$, M: the mass of membrane after absorbing water, $M_{membrane}$: the pure film's mass)

As shown in figure S2, with crosslinked time increasing from 2h to 5h on PVA/L-H/AgNPs membrane by mixed gas atmosphere of hydrogen chloride and glutaraldehyde, water absorbing ratio increases from 621 g/g to 885 g/g, this is due to the increase of crosslink density and mesh point by crosslinking agent[4], thus, making the PVA structure from a line into a three-dimensional network structure, which is beneficial to the membrane to keep and absorb the moisture. However, because of convergence meshes and the poor water-soluble for PVA nanofibers after crosslink, the bibulous rate reduced gradually, eventually the bibulous rate was 555 g/g. Because of the excessive crosslinking, the PVA increased convergence meshes, which could strengthen the rigid structure[4], but not the water absorption.

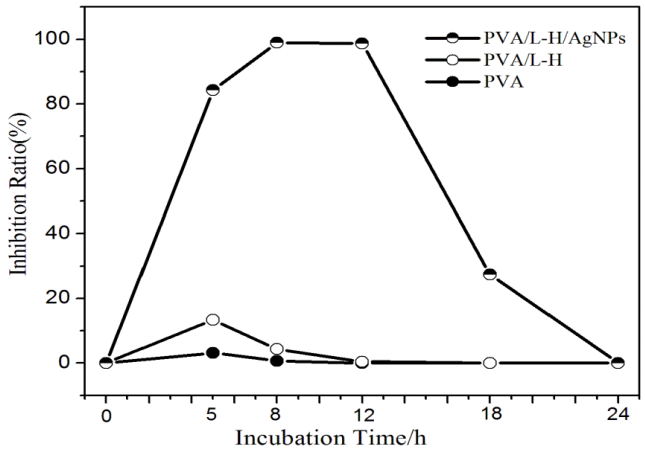

Figure S3: bactericidal kinetic study against *E. coli* of the membranes of PVA, PVA/L-H, PVA/L-H/AgNPs

Fig. S3 shows the bactericidal kinetic testing for *E. coli*, the fibers (10mg) were put into 50 mL bacteria nutrient solution with the initial concentration of *E. coli.* for ca. 10^4 CFU mL^{-1}. As we can see from the Fig. S3, the in hibition ratios were 3.2%, 13.4%, 84.3% at the 5th hour corresponding to PVA, PVA/L-H, PVA/L-H/AgNPs membranes respectively. As the contrast, the PVA/L-H showed certain antibacterial ability, which can be ascribed to the antibacterial ability of L-histidine in some certain degree[5]. When the incubation time reached 8 h, the fibers without AgNPs nearly lost inhibition ability. However, PVA/L-H/AgNPs membrane showed excellent inhibition ratios about 98.9% and it was 98.7% in inhibition ratios at 12th hour; which were almost equal to the inhibition ratios at the 8th hour. Finally, the inhibition ratios of the membrane containing AgNPs decreased to 27.4%, which indicated the termination of inhibition. Since the bacteria would consume silver ions in the process of incubation. The data indicated that the PVA/L-H/AgNPs membrane have sound antibacterial effects against *E.coli* under the experimental conditions, which support their applications as antibacterial materials in the future.

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