PREPARATION AND PROPERTIES OF HAEMOSTATIC POWDER AND FILM

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Background

Blood contains 18-19 g/dl of proteins, of which 7-8% is plasma and 10-12% is globin. Those are very useful and valuable materials. Plasma contains fibrinogen, thrombin and factor XIII which are blood coagulant factors. It has been found there are many valuable biomedical materials. If they can be utilized, it can increase blood value and decrease environmental pollution. In 2003, we extracted fibrinogen and thrombin from porcine blood as a haemostat solution and investigated its effectiveness of clotting. We found it had very effective haemostatic action (Chen et al., 2003), thus, we try to develop other forms of haemostats.

Objectives

This study is to use fibrinogen and thrombin to prepare freeze-dried powder and haemostat film, and investigate the properties of the products.

Materials and methods

Fibrinogen and thrombin are extracted by the methods described by Futami et al. (1984) and Divakaran (1982), respectively. The two extracts are dried by freeze-drying to make powder. Haemostatic films are prepared with the combination of original extract solutions of fibrinogen and thrombin by the ratio of 20:1 and added with 12% of 0.25M $CaCl_2$ and coagulated on the surface of petri dish. The films are dried using freeze-drying, and 40□ oven drying for overnight and for five hours, respectively. The solubility and turbidity of the powder products are analyzed. Thickness, water absorption and swelling rate of films are also measured.

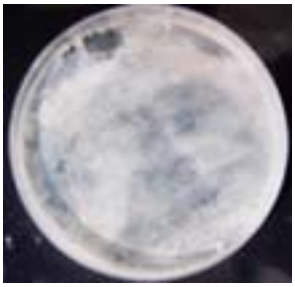
Results and discussion

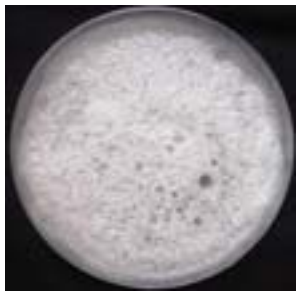
The activity of thrombin, properties and haemostatic function of thrombin and fibrinogen have been studied before (Chen et al., 2003). Figure 1 shows fibrinogen and thrombin powder dried by freeze-drying. The solubility and turbidity for the freeze-dried fibrinogen are 51.2% and 21.5, and for thrombin are 14.35% and 10.1, respectively (Table 1). Figure 2 shows moisten film, oven dried film and freeze-dried film. It is found the thickness and swelling rate of the moisten
film is higher than the others. The moisten film is also more elastic. The water absorption of freeze-dried film is higher than the others and absorbed more water. The picture of freeze-dried film is more porous(Figure 2c). When it is used to arrest the bleeding it may absorbed more blood. In other words, it is more effective on haemostatic action.

fibrinogen

thrombin

Fig. 1 Pictures of freeze-dried powders of fibrinogen and thrombin.





a. moisten film b.oven-dried film c. freeze-dried film

Fig. 2 Pictures of films

Table 1. Solubility and turbidity of freeze-dried powders of fibrinogen and thrombin

Iterms	**Fibrinogen**	**Thrombin**
Solubility(%)1	51.2	14.35
Turbidity(T)2	21.5	10.1

1. Solubility(%)=(protein in supernatant)/total proteinx100.
2. Turbidity=transmittance at 540nm

Table 2.Thickness, water-absorption and swelling rate of haemostatic films

Iterms	Moisten film	Oven-dried film	Freeze-dried film
Thickness(mm)	2.62	1.72	2.29
Water-absorption(%)	6.13	27.14	180
Swelling rate(%)	21	1.16	-30

Water absorption(%)=((Wa-Wb)/Wb)x100 Wa=weight after soaking in water
Wb=weight before soaking
Swelling rate(%)=((Ta-Tb)/Tb)x100 Ta=thickness after soaking
Tb=thickness before soaking

Conclusions

This study is to use fibrinogen and thrombin separated from porcine blood to prepare haemostatic powder and film. The result of film thickness is different due to the methods of preparation. It was found water-absorption of freeze-dried film is higher than the others, and the swelling rate was found higher in moisten film

References

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