以共製法結合賦形劑之微晶纖維素的特性與功能性研究

Studies on the Characteristics and Functionality of Microcrystalline Cellulose by Co-drying with Excipients

中文摘要

微晶纖維素(Microcrystalline cellulose, MCC)是經由強酸水解木材的α-cellulose，而得到聚合度大約爲 200 至 300 的葡萄糖分子聚合體。由於其具備良好的壓錠性，以及低化學反應活性，使得微晶纖維素被認爲是目前最有用的直接壓錠賦形劑之一。然而由於微晶纖維素顆粒形狀的不規則，使得其粉末的流動性不佳，造成錠片重量上的差異。另外其所製得之錠片崩散度不佳。因此爲了能有效的改善甚至解決這些問題，所以本研究的目的即是希望藉由與微晶纖維素分子基本結構相似的碳水化合物類賦形劑(包括：不同等級的低取代羥丙基纖維素，Low-subsituted hydroxy-propyl cellulose, L-HPC)或同時具有高水溶性的材質(包括：葡萄糖、甘露醇、及山梨醇)與微晶纖維素溼團塊共同乾燥製備來修飾微晶纖維素的物理性質，並藉由其錠片功能性的探討來評估與微晶纖維素溼團塊共製的效果。

首先由粉體性質的實驗結果顯示經由共同乾燥後的粉末明顯比物理混合後具有較佳的流動性。而由掃描式電子顯微鏡分析圖中可以了解其流動性的差異可能是由於其顆粒形狀的不同所造成，共製後之粉末顆粒形狀規則且表面光滑，而物理混合則呈不規則狀，其顆粒表面如片狀斷層。錠片功能性探討中，物理混合的錠片具有較高的硬度及強度，然而其 Yield Press-ure 較高。而共製之錠片其 Yield Pressure 較低，具有較好的壓錠性，且主要以塑性形變的方式成錠。在單糖類與微晶纖維素共製中，山梨醇之錠片顯示出較好的錠片強度，而低取代羥丙基纖維素類錠片強度則較單糖類好。在錠片的崩散試驗及吸水速率實驗中，經由共製後之錠片其崩散時間明顯比物理混合短，尤其是微晶纖維素與低取代羥丙基纖維素共製之錠片具有快速崩散的能力。而物理混合的崩散時間幾乎超過三十分鐘。綜合以上所述，雖然經由共製的過程下降了微晶纖維素的硬度及總體強度，但其硬度仍在可接受的範圍內，並且共製處方能有效的改善微晶纖維素的流動性，且擁有較佳的崩散效果。因此共製的粉末處理方式能提供日後製造或修飾賦形劑的有效方法。

英文摘要

Microcrystalline cellulose (MCC) is derived from purified wood α-cellulose by a severe acid hydrolysis, yielding a cellulose with a degree of polymerization (D.P.) of about 200 to 300. Because it equipped with an excellent compactibility and a low chemical reactivity, it makes the MCC to become one of the most useful excipient of direct compression tableting. Because the particle shape of MCC is irregular, it causes

bad flowability, the variation of tablets weight, and the poor disintegration properties. In an attempt to improve or solve these problems, the aim of this study was to modify the physical characteristic of MCC by co-drying of MCC slurry with the carbohydrate excipients which are similar to the basic molecular structure of MCC (that including various grades of Low-substituted hydroxypropyl cellulose, L-HPC), or with the materials which have high solubility (that including glucose, mannitol, and sorbitol). Furthermore, functional performances of the co-dried MCC slurry with these excipients were investigated.

Firstly, the result of the powder property has shown the co-dried powder had a better flowability than physical mixtures. SEM photographs revealed that the difference of the flowability was caused by the different particle shape. The particle shape of MCC after co-dried is regular with a smooth surface, but the physically mixed one is irregular with chipped edge. In the examination of the tablet's functionality, most of the tablets with physical mixture demonstrated a higher value of hardness and tensile strength but with a higher yield pressure. The co-dried tablets had a lower yield pressure with better compressibility and their compression mainly through plastic deformation. Moreover, the tensile strength of tablets produced from MCC co-dried with sorbitol was better than the tablets produced from MCC co-dried with other monosaccharides. Nevertheless, the tensile strength of tablet prepared with co-dried MCC with L-HPC was better than co-dried with various monosaccharides. In the disintegration test and the rate of water uptake experiments, the disintegration time of tablet parpared with co-dried MCC is shorter than the physical mixtures. Especially, the tablets prepared with MCC co-dried with L-HPC had a rapid disintegration rate. However, the disintegration time of tablets from physical mixtures was almost over 30 minutes.

Generally, although the hardness and tensile strength of tablets prepared with co-dried MCC with excipients would lower, the flowability and the disintegration ability would be efficiently improved. Therefore, the co-dried process with be an efficient method for development new excipientds with excellent characteristics.