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CHITOSAN/ANIONIC POLYELECTROLYTE BLENDS

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Chitosan, which is usually obtained by alkaline deacetylation of chitin, one of the most abundant organic materials, is known to be bioactive and there are a number of reports, *inter alia* [1-6], of benefits obtained from its use in medical applications. Other natural polyelectrolytes such as sodium alginate, heparin and hyaluronic acid, and modified natural polymers such as carboxymethyl cellulose, are also known to have important medical applications and synergistic effects could be expected from blends of chitosan with these materials. However all of these other natural polyelectrolytes are anionic in character - one important characteristic of chitosan is that it is the only major naturally occurring polyelectrolyte that under acid conditions is cationic in character - and precipitates are rapidly formed on mixing solutions of chitosan and sodium alginate[7], heparin[8], hyaluronic acid[9] or other anionic polyelectrolyte[10]. These precipitates have been found to be bioactive and bioresorbable but, because of their intractability, preparation in usable forms such as films, fibres or sponges has not, to date, been possible.

Recently a novel method has been developed for solubilising chitosan, in which the chitosan dissolves through being converted temporarily to an anionic polyelectrolyte in which form it is compatible with other anionic polyelectrolytes[11]. Preliminary studies have shown that this solubilisation process is applicable to chitosan samples covering a wide range of molecular weights and levels of deacetylation. It may therefore reasonably be inferred that it is applicable to all chitosans, as previously defined[12], regardless of their composition. Furthermore it has been shown that when solubilised in this way chitosan will form concentrated mixed solutions with anionic polyelectrolytes such as sodium alginate, sodium carboxymethyl cellulose and carrageenan. These solutions are stable, showing no evidence of precipitation on standing for up to 21 days at room temperature, and fibres, films and sponges have

been produced from them in the laboratory. Previously, films combining chitosan and anioic polyelectrolytes had either a "sandwich" structure formed from separate layers of chitosan and the anionic polyelectrolyte, or consisted of fine particles of chitosan or the anionic polyelectrolyte dispersed in a matrix of the second component[13, 14], rather than the intimate blends made possible by the new solvent system. Therefore these chitosan/anionic polyelectrolyte blends represent a new class of materials with considerable potential for medical and pharmaceutical applications because of the likely synergistic effects arising from the intimate combination of two or more bioactive materials.

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