Many native proteins possess limited functionality, and modification such as succinylation is often performed to expand the range of functional properties available for pharmaceutical dosage form. Succinylation could be useful for modulating protein-based system swelling and drug delivery properties especially for sustained controlled release dosage form like microsphere. A well designed controlled drug delivery system can overcome the problems of conventional drug therapy and gives better therapeutic efficacy of a drug. Microspheres are also undersigned as novel controlled drug delivery systems having particle size less than 200 μm.

The aim of this research was succinylated soybean protein (SSP) that could be used as excipient matrix for sustained release microspheres containing propranolol hydrochloride as a model active pharmaceutical ingredient.

Soy protein chemical modification was carried out as follows. Soy concentrated protein was dispersed in distilled water for 2 h at a concentration of 5% w/v, and stirred 2 hours with a speed of 1000 rpm. After dissolved succinic anhydride at concentration 100% w/v in ethanol 96% was added gradually to the soy concentrated protein with constant stirring and the pH was maintained between 8 and 8.5 with 5 N NaOH. The reaction was completed when the pH of the protein solution stabilized. Excess Succinic anhydride was removed with ethanol 96%, and suspension of soy protein succinate was neutralized with HCl 0.5 N then dried in an oven at 40–45 °C. Percentage yield of succinylated soybean protein produced was 72,14%.

After that the product was analyzed included; degree of succinylation, data of chemical interaction between soybean protein and succinic anhydride analyzed by FTIR spectroscopy, solubility index in aqueous medium at pH 1.2 and pH 7.5, swelling index. Succinylated soybean protein was used as matrix in formula microsphere with propanolol HCl as a model active pharmaceutical ingredient.
Succinylated soybean protein produced is slightly yellow colored, tasteless powder, and Chunk of irregular particle morphology. The degree of substitution (DS) of Succinylated soybean protein is \(35.74 \pm 0.38\)%. Chemical interaction showed peak in wave at numbers 1653 cm\(^{-1}\) on IR spectrum which is indicating formed amide carbonyl group; has solubility index \(0.21 \pm 0.010\) gram/100 ml in distilled water at pH 1.2 and \(0.35 \pm 0.003\) gram/100 ml and pH 7.5. Succinylated soybean protein product has swelling index 33.21 \(\pm\) 2.04% at pH 1.2 and 66.36 \(\pm\) 2.12% at pH 7.5, and water content in the powder 5.9%.

Sustained release microspheres of propanolol HCl were made three formulas by using spray dryer method. The microspheres have particle size diameters range 11.54–16.79 \(\mu\)m, yield values 36.46–58.91%, and encapsulation efficiency values 95.75–99.81%. The composition of the formula 1 is 0.5% propanolol HCl: 2% Succinylated soybean protein, for formula two 1.0% propanolol HCl: 2% Succinylated soybean protein and formula three 0.5% propanolol HCl: 2% soybean protein. Formulations F1, F2 and F3 were taken into consideration for in vitro release studies. In vitro release studies were carried out in HCl pH 1.2 and phosphate buffer pH 7.4 for a period of 12 h.

Characteristics of microspheres of propanolol HCl have particle size distribution based on diameter volume of formula 1, 2, 3 (11.54 \(\mu\)m, 14.70 \(\mu\)m, 16.79 \(\mu\)m). Entrapment efficiency of propanolol HCl into microspheres matrix excipient were formula 1 (99.81 \(\pm\) 1.95%), formula 2 (92.65 \(\pm\) 1.32%) and formula 3 (95.75 \(\pm\) 1.80%). Swelling index of microsphere for 12 hours at pH 1.2 and pH 7.5 were formula 1 (13.17 \(\pm\) 4.18%; 15.15 \(\pm\) 2.62%), formula 2 (11.12 \(\pm\) 6.45%; 30.46 \(\pm\) 3.04%) and formula 3 (43.96 \(\pm\) 7.39%; 5.12 \(\pm\) 4.44%).

In vitro drug release profile showed that the cumulative percent release was found to be 81.58 \(\pm\) 3.04%, 63.05 \(\pm\) 0.04%, and 61.11 \(\pm\) 1.58 for formulation F1, F2, and F3 respectively. We conclude that these studies indicated that succinylated soybean protein can be used as excipient for matrix sustained release microspheres. The release rate of propanolol HCl (drug) from the microspheres could be properly controlled for about 24 h. Appropriate variation in the proportions of drug and excipient for matrix microsphere can lead to a product with the desired controlled release features.

**Further Reading**


