Protein therapeutics is considered to be one of the most encouraging and decisive areas of recent time due to its specificity and low genetic risks compared to small molecule drugs. Although a wide array of brilliant delivery vehicles has been reported, the key issues are still being the instability of protein in serum and lack of proper reversible protection throughout the delivery pathway. To address these issues, we have designed a polymeric delivery vector that can encapsulate proteins and would effectively protect the payload until its intra-cellular delivery and consequent release. We envisaged the feasibility of exploiting a self-immolative backbone structure of a polymer to covalently capture proteins through lysine moieties and protect them by shrink-wrapping with crosslinking reaction. The chemical handles also enable to tune the activity of proteins. In summary, the developed strategy provides a simple and robust delivery platform potentially applicable to a broad range of proteins.