Emerging trends in stimuli responsive nanomaterials for oral drug delivery

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**Abstract:**

Site specific oral delivery of many biopharmaceutical classification system (BCS) class II and IV molecules is challenging due to their poor solubility, permeability and potential degradation in the gastrointestinal tract. The development of reliable oral delivery systems for problem drugs and biologics is one of the biggest challenges faced by the pharmaceutical industry in recent times. However, oral delivery of many small molecule drugs and most of the peptide drugs is challenging due to hostile environment in gastrointestinal tract, poor solubility and permeability. This results in their limited commercial use, as well as serious clinical development trade-offs that often result in poor efficacy and side effects associated with it. The use of bio-responsive nanoparticles for improving the bioavailability of such drugs is gaining more and more attention. However, most nanoparticle-based drug delivery systems suffer from many disadvantages, such as low encapsulation efficiency (liposomes, polymeric nanoparticles), complex synthesis methods (silica, silicon based materials) and poorly understood biodegradability (inorganic nanoparticles). Therefore there is a compelling need for development of new generation of stimuli responsive materials with high loading capacity, and improved site specific delivery. We have developed several generation of mesoporous silica nanoparticles based nanocomposites for oral delivery of small molecules ( Curcumin, Vorinostat, Resveratrol ) and macromolecules ( Exenatide, Interlukin-22 ). Given that it takes more than 2 decades for a drug to become clinically available, our platform technology provide much-needed impetus in the area of oral drug delivery of challenging molecules.

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