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Drug nanocrystals and cancer therapy

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Nanocrystals are a carrier-free colloidal delivery system. These are nano-sized particles which are useful in the diagnosis and treatment of cancer. Nanotechnology is an interesting approach for providing various benefits in diagnostics and therapeutics of cancer. A highly sensitive nanoparticle can be used to diagnose cancer through blood, urine or saliva which makes it a minimal invasive procedure which is almost painless for the patient. It also provides clearer images of the cancer affected cells which form as lumps or tumors. In case of poorly soluble drugs, it provides special features like enhancement of saturation solubility, dissolution velocity and adhesiveness to the cell membranes which can be used to treat cancer efficiently. When investigations on semiconductor nanocrystal quantum dots started more than a quarter of a century ago, it was hard to believe that nanoparticle research would develop into a major field in modern science. The studies were mainly based on principles of photocatalysis and artificial water splitting driven by oil crisis. The low solubility and absorptivity of drugs is a major problem which limits the development of highly potent drugs which can be used to treat cancer. The drugs with low solubility lead to low oral bioavailability and erratic absorption which is particularly observed in class II drugs of the Biopharmaceutical Classification System (BCS). Generally, the rate-limiting step for absorption of the drugs in this class is the dissolution velocity arising from low solubility. To overcome the solubility problem nanotechnology is most useful technique. Nano suspensions are the submicron biphasic colloidal dispersions of the active pharmaceutical ingredient (API) particles in a liquid phase, size below 1 μm , without any matrix material which are stabilized by surfactants and polymers. Nano suspensions are nanoparticles being composed of 100% drug without any matrix material. In this presentation the focus is given on various techniques conventional as well as patented technology used for preparation of nanocrystals for the treatment of cancer. There are certain characterization parameters such as particle size, polydispersibility index, surface morphology, particle surface charge, crystalline state, surface hydrophilicity, adhesion properties for the nanocrystals formulation. This is suitable drug delivery system for all commonly used routes of administration such as oral, IV, SC, IM and topical application. In addition, nanocrystals can be incorporated into the tablets, capsules, fast-melts and lyophilized for sterile product applications. The process of nanonization of these drugs makes them 100% bioavailable and increases their therapeutic window which lowers the risk of toxicity or any adverse effects and the patient compliance for the drug also increases as they are very small in size and are highly potent. Hence, the challenges in the development of cancer drugs can be easily vanquished.

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