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Aptamer-conjugated nanoparticles in drug delivery to target cancer cells

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Many of the chemotherapeutic drugs are poorly effective and cause several side-effects owing to insufficient targeted delivery. Aptamers are oligonucleotides that have high sensitivity and specificity, which allow them to bind to specific cell surface receptors. These aptamers when bound to the surface of drug-carrying nanoparticles, guide the nanoparticles to the target cells where the aptamers can bind to the cell surface receptors, enabling the drug release at the targeted site. Poly lactic-co-glycolic acid (PLGA), a biodegradable polymer with high biocompatibility and controlled drug release feasibility is highly renowned in drug delivery applications. PLGA nanoparticles allow surface modifications and can enter deep into fine capillaries, which grant their entry into tissues. These PLGA nanoparticles are loaded with an anti-cancer drug; aptamers are conjugated to their surface, which help them reach the targeted cancer cells, bind to their receptors, and release the drug. This is an effective alternative to poor bioavailability, non-specific biodistribution, and toxicity of anti-cancer drugs that are administered orally. Moreover, it increases the bioavailability of the anti-cancer drug as a result of its targeted release, improving its pharmacological efficiency by increasing pharmacokinetic and pharmacodynamic profiles of the drug. Implementation of research based on aptamer-nanocarrier conjugates helps overcome many problems that arise from the usage of conventional anti-cancer drug delivery systems.

Keywords: Aptamer, Nanoparticles, Biocompatibility, Toxicity, Biodistribution, Oligonucleotides

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