palmitate [103,104], acyclovir [105,106], azidothymidine palmitate [104], gadolinium (III) complexes [107], cyclosporine [108], etomidate, tetracaine [109], vitamin E palmitate [110], progesterone, hydrocortisone [111], and camptothecin [112].

3.4. Mesoporous Silica Nanoparticle

In 2011 the US FDA approved silica nanoparticles for Phase I human clinical trials, it was an important initiative toward clinical acceptance of silica nanoparticles [113]. Mesoporous silica materials which consist of porous structure with hundreds of empty channels such as honeycomb (mesopores) structure used for drug delivery such as MCM-41 (Mobil Composition of Matter) and SBA-15 (Santa Barbara University mesoporous silica material). This gives the possibility of using these nanomaterials in a combined drug delivery therapy. These porous structures can encapsulate large amount of drug molecules [114], and it has made silica nanoparticles (SiNPs) highly attractive carrier because of wide applications of nanotechnology to enhance the characteristics of nanoparticles such as adsorption, sensing, catalysis, and separation [115–120]. Mesoporous silica nanoparticles (MSiNPs) structure enables adsorption of DNA and gene transfer [114].

3.5. Liposome Nanocarrier

Liposomes vesicles made up of single or numerous lamellae layers (lipid bilayers) consist of the aqueous core inside suitable for encapsulation [121]. Liposomes are clinically developed nanocarriers to deliver genes, cytotoxic and antifungal drugs, vaccines, and imaging dye [122] and it is also used to enhance the functionality of several types of nanoparticles such as hydrophilicity, stability in plasma, controlled delivery, and improved biocompatibility. Additionally, the cationic liposomes can interact with oppositely charged molecules that are attached to them on the surface. This property makes liposomes suitable to conjugate with ligands or antibodies for targeted delivery [123]. Some liposome-based drugs such as anthracyclines doxorubicin (Doxil and Myocet), liposome-encapsulated curcumin, and albumin-paclitaxel nanoparticles were suitable for the treatment of cancer and liposomal daunorubicin (DaunoXome) for AIDS-related Kaposi's sarcoma [124–127].

3.6. Polymeric Nanocarriers

Polymeric nanoparticles are biodegradable and biocompatible size ranges of 10–1000 nm. Drugs can be physically adsorbed on the surface of the polymer or chemically linked to the surface and encapsulated in the core of polymer nanocarriers [128]. Biodegradable polymers that are used for encapsulation of a variety of therapeutic compounds are poly(D,L-lactic-*co*-glycolic acid) (PLGA), poly(ε-caprolactone), poly(D,L-lactic acid) (PLA), and poly(ethylene glycol) (PEG). In South Korea for Genexol-PMTM, a PLGA-*b*-methoxy PEG NP encapsulating paclitaxel has received regulatory approval for cancer treatment and is undergoing phase II clinical trials in the United States [129]. Moreover, these polymer nanoparticles are not only suitable for delivery of small molecule drugs but with the array of polymer and surface modification techniques, it can also be used to deliver proteins [130], diagnostic agents [131], and nucleic acids [132].

3.7. Dendrimer

Dendrimers are roughly large spherical, three-dimensional branched structures that have a typically symmetric core, size ranges of ~10 nm due to which drug incorporation into dendrimers can be limiting [133–135]. Besides drugs, it is also used to deliver genes, sensors, and killing the bacterial cell [135–137]. Poly(amidoamine) or PAMAM (polypropylenimine dendrimers) are the commonly used dendrimers. PAMAM dendrimers conjugated with anticancerous drug cisplatin showed controlled release with minimum toxicity and high accumulation in solid tumors as compared with free cisplatin [138]. According to Chauhan et al., [139] PAMAM dendrimer-loaded indomethacin enhances the bioavailability of nonsteroidal antiinflammatory drug indomethacin in transdermal delivery applications.

3.8. Polymeric Micelles Nanoparticles

Micelles are lipid molecules that organize themselves in a circular form in aqueous solutions and exhibit a core and shell structure. Its morphology has significantly enhanced the impact of pharmacokinetic properties [140]. The core is hydrophobic in nature which is used for the encapsulation of drug whereas the hydrophilic shell provides aqueous solubility and steric stability to the micellar structure [141]. Depending on the solvent environment and relative length of hydrophobic/hydrophilic blocks micelles form a variety of shapes such as vesicles, spheres, tubules, rods, and lamellae [142–144]. Polymeric micelles nanoparticles are broadly used in experimental studies as a carrier for the delivery of poorly water-soluble drugs. Micelle carrier enhances the solubility and reduces early degradation of anticancerous drugs and accumulates at the tumor site. Micelles nanocarrier which are used in clinical trials or in clinical use are mPEG-PLA (paclitaxel) for breast cancer [145], Pluronic L61 and F 127 polymeric micelle (doxorubicin) for lung cancer [146], PEG-PGA polymeric micelle (Cisplatin) for