nanoparticle without any negative side effects. Additionally the applied dose of drug decreased to 20% of the regular systemic dose [68,69]. Lubbe et al. studied the treatment of Phase I human clinical trial which showed positive results of the physiological tolerance of magnetic drug (4-epidoxorubicin) by patients [70].

Gold and silver nanoparticles are ideal for various pharmaceutical applications and drug delivery because of their stability, noncytotoxicity, inert nature, high disparity, and biocompatibility [71]. Previous studies showed the treatment of intracellular infections with conjugates of gold nanoparticles and antibiotics provide promising results [72,73]. The association of gold nanoparticles in antibiotic treatment enhances the efficiency of drug delivery to target cells [74,75]. The amount of dose required in this therapy is higher than the actual amount required for pathogenic treatment. The overdose of antibiotics can cause adverse effects [76] because of this gold nanoparticle with antibiotics conjugates helps targeted delivery and reduces the amount of dose with improving antibiotic efficacy. Chen et al. studied methotrexate drug conjugated to 13-nm colloidal gold. Methotrexate is an anticancerous drug an analog of folic acid that can destroy cells folate metabolism [77]. Li et al. demonstrated the study of functionalized gold nanoparticles (AuNPs) which showed an important role in efficient drug delivery and biomarking of drug-resistant leukemia K562/ADM cells. It also indicated that the AuNPs interaction with biologically active molecules on the leukemia cell surface may contribute to the observed improvement in cellular drug uptake [78]. The conjugation of gold nanorods and small interfering RNA (siRNA) by electrostatic binding has used for targeted delivery of siRNA to specific cells or tissues [79].

Silver nanoparticles (AgNPs) are used for the treatment of diseases by targeting specific cells, such as interacting with the HIV-1 virus and inhibiting its ability to bind host cells in vitro [80]. Bhattacharya and Mukherjee studied nanocrystalline Ag and Ag sulfadiazines that are used for wound healings to treat ulcers and to treat burn wounds, respectively, in the form of pastes or creams [81].

Some metallic nanoparticles are used in the form of metal oxides NPs such as zinc oxide nanoparticles (ZnONPs) and titanium dioxide nanoparticles (TiO_2NPs) as a skin protector in sunscreen [82]. The ultraviolet radiations (UV) have the ability to damage DNA in human skin cells by inducing oxidative stress and it also plays an important role in the cause of pathogenesis of melanoma and nonmelanoma skin cancer [83]. Therefore for the protection of the skin from cancer development against both UVA and UVB radiation, some metallic nanoparticles are used in the form of metal oxides NPs such as ZnONPs and TiO_2NPs as skin protectors [82].

Cobalt oxide nanoparticles (CoONPs) have different physical and chemical properties such as catalytic, magnetic, and optical properties. Additionally, CoONPs have anticancerous properties and these nanoparticles have excellent uptake of cancerous cells after surface modification when attached with amide. Chattopadhyay et al. [84] showed doxorubicin and methotrexate-attached folic acid PMIDA-coated CoONPs used as a carrier for targeted anticancer drug delivery.

3.2. Chitosan Nanoparticles

Chitosan is a naturally founded polysaccharide, highly basic, cationic, mucoadhesive biocompatible polymer extracted from crustacean shells of crabs or prawns and cell walls of fungi and used as drug carrier and in tissue engineering approved by US Food and Drug Administration (FDA) [85]. Chitosan NPs are useful for slow/controlled drug release and they can cross biological barriers in vivo and delivering drugs to enhance the efficacy of the targeted site which improves drug stability and solubility, enhances efficiency, and reduces toxicity [86]. The function for drug delivery of chitosan NPs and poly(D,L-lactide-*co*-glycolide) (PLGA) nanoparticles [87] is similar but the chitosan NPs drug delivery is more pH dependent [88]. Mohammed et al. studied exendin-4 loaded PLGA and chitosan-PLGA NPs for the treatment of type-2 diabetes [85]. Tamoxifen-loaded lecithin-chitosan NPs increased the solubility and permeation of drug across the intestinal epithelium and it is useful for oral cancer drug delivery [89]. Liu et al. showed that Carbamazepine drug which is used for epilepsy treatment, its brain-to-plasma exposure ratio reached to 150% and also enhances the bioavailability of drug to cross the blood brain barrier (BBB) when loaded with chitosan NPs [90].

3.3. Solid Lipid Nanoparticles

Solid lipid nanoparticles (SLNPs) are emerging pharmaceutical delivery system submicron size range 50–1000 nm are used as alternative carriers to colloidal systems, for controlled and precise drug delivery [91,92]. SLNPs are synthesized from biocompatible and biodegradable materials which have an ability to carry or localize the lipophilic and hydrophilic drugs in the solid lipid matrix [93,94]. There are several drugs which have been incorporated into SLNPs [95] for therapeutic purposes such as desoxycortisone [96], timolol [96,97], idarubicin, doxorubicin [98], [D-Trp-6]LHRH [99], pilocarpine [100], thymopentin [101], oxazepam, diazepam, cortisone, betamethasone valerate, retinol, prednisolone, retinol, menadione, ubidecarenone [102], 3′-azido-3′-deoxythymidine