nanocarriers are chemically synthesized by controlled polymeric reaction embracing both hydrophobic and electrostatic interactions. Moreover the easy amendment of surface, biocompatibility, high loading capacity, multiple point of conjugation and proportioned shape of this nanocarrier makes it the effective nanocarrier drug delivery system [122].

Recently, beclometasone dipropionate (BDP) containing polyamidoamine (PAMAM) dendrimers have been developed and evaluated for aerosolization, solubility and drug release properties. The result of the study revealed that these BDP-dendrimers could be potential nanocarrier system for inhalation using both air-jet and vibrating-mesh nebulizers in patient suffering from pulmonary disease like asthma [123]. With the formulation of autophagy-inducing compounds, now researchers are expanding their horizon by developing dendrimer formulation for inhalation for stable, longer half-life and targeted delivery of therapeutic agent [124]. The published literature has reported about the development of mannosylated G5 EDA-PPI dendrimer containing ethylene diamine in its core for selective delivery of rifampicin in patients suffering from TB [125]. Another study reported about the formulation of polyplex for targeted delivery of RNAi genes as a treatment for cancer. This polyplex was modified form of PAMAM dendrimers with the help of bromodecanoic acid and PEG. The in vitro evaluation on A549 cell line of lung cancer of this polyplex revealed about the efficacy of this nanocarrier in knocking down the Bcl-xL expression and inducing apoptosis in cells [126].

## 5.7. Micelles

For targeted and regulated release of hydrophobic antineoplastic drug, micelles nanocarrier systems are usually used. They serve as the candidate of interest as they are composed of hydrophobic core of *co*-polymers. This co-polymer hydrophobic core allows the loading of hydrophobic drugs whereas hydrophilic shell allows the attachment of hydrophilic drugs [127]. Moreover, hydrophilic shell of this nanocarrier system also enhances is stability in the biological system. This nanocarrier system is found in different sizes ranging from 20 to 100 nm, which makes it effective for loading high amount therapeutic agent [128]. As micelles provide the benefit like enhanced drug permeability, improved circulation time and uniform distribution has made it suitable candidate for passive-targeted therapy. Surface modification of these micelles substantially improves it targeting efficiency and biodegradable nature of this nanocarrier system makes it effective tool for drug delivery at targeted site [129].

As angiogenesis is one of the characteristic features of asthma and to regulate this, anti-angiogenesis therapeutic agents have gained significant attention. The study was conducted in which $\alpha_v\beta_3$-mixed micelles was loaded with docetaxel-prodrug and evaluated for controlling the hyper-response to mite dust triggered asthma in rat. The result obtained revealed about effectiveness of the nanocarrier system in ameliorating the inflammatory response in rat model [130]. Another study reported about self-assembling micelle formulation containing chafuroside A, which was evaluated for anti-inflammatory effect in COPD rat model. The result obtained from this study showed improved dissolution of chafuroside A and target delivery of the therapeutic agent suggesting the benefit of this approach [131]. Moreover, the group researchers have developed rifampicin-loaded HPMA-PLA polymeric micelles, which showed improved result against both resistant and sensitive *M. tuberculosis* [132]. Another study reported about the development of matrix metalloproteinase 2/9 (MMP2/9)-triggered-release micelles, which were evaluated for both in vivo and in vitro studies against lung cancer. The approach showed effective result in reducing the toxicity induced by chemotherapy on healthy lungs in nude mice model [133].

## 5.8. Micro-emulsions

Microemulsions are the monophasic, optically isotropic, thermodynamically stable, and transparent colloidal dispersion made up of co-surfactant, surfactant, water and oil having size within the range of 100 nm. These are also stated as monodispersed spherical droplets of oil in water (o/w) or water in oil (w/o), which depends on the surfactant used for its preparation [134]. These nanocarriers are found to be thermodynamically stable and have the ability to enclose both hydrophobic and hydrophilic drugs. Additionally, this nanocarrier system provides more bioavailability as well as solubility to drug and has high permeable power than other nanocarrier system [135]. These properties are key features of these nanocarrier systems which makes it ideal candidate for targeted drug delivery.

With the advancement in the nanomedicine, the group of researchers formulated micro-emulsion nanocarrier system for improving the bioavailability and solubility of fenofibrate for asthma (L. [136]). The comprehended previous literature reported about the optimization of simvastatin-loaded microemulsion and their evaluation in in vivo system was also done. The result showed the better efficacy of this system in targeted delivery of insoluble drug via oral route for COPD [137]. Another study reported about the