Prediction of optimum compositions of parenteral nanoemulsion system loaded low water solubility drug for treatment of schizophrenia by artificial neural networks

ABSTRACT

Aripiprazole was encapsulated in the palm kernel oil esters nanoemulsion for the purpose of brain delivery via intravenous administration. High shear and high pressure homogenizers were applied for formulating low solubility drug in the nanoemulsion system and stabilized by different emulsifiers; lecithin, Tween 80 and glycerol. The artificial neural networks (ANNs) modeling of nanoemulsion formulation was carried out to achieve the minimum particle size. The effects of palm kernel oil ester (PKOE) (3-6%, w/w), lecithin (2-3%, w/w), Tween 80 (0.5-1%, w/w), glycerol (1.5-3%, w/w), and water (87-93%, w/w) amounts on the particle size were considered as inputs of the network trained. The particle size of samples in various compositions was measured as output. To obtain the optimum topologies, ANNs were trained by Incremental Back Propagation (IBP), Genetic Algorithm (GA), Batch Back Propagation (BBP), Quick Propagation (QP), and Levenberg-Marquardt (LM) algorithms for testing data set. The topologies were determined by the indicator of minimized root mean squared error (RMSE) for each algorithm. According to the results, the QP-5-4-1, GA-5-12-1, IBP-5-11-1, BBP-5-10-1, and LM-5-9-1 were selected as the optimized topologies. It was found that the optimal algorithm and topology were the quick propagation and the configuration with 5 inputs, 4 hidden and 1 output nodes, respectively. Conclusively, ANN models were developed for the prediction of particle size of nanoemulsions loaded with aripiprazole and stable nanoemulsion system which could be used effectively for intravenous administration.

Keyword: Parenteral nanoemulsion system; Low solubility drug; Schizophrenia; Artificial neural network