Abstract

High performance Contact Lenses (CLs) can be made of transparent polymers due to the evolution in their merits such as biocompatibility to the eye tissues and the ability to modify their refractive index (n) and Abbe number (ν_d). This work included an investigation of high n and ν_d materials for CLs fabrication by nanotechnology for vision correction.

Pure and doped polymers with high optical properties are selected and simulated using ZEMAX based on Liou and Brennan eye model (LBEM) without CL as a reference for comparing the CLs effect on vision correction. The best material was manufactured experimentally in different concentrations of TiO_2 NPs. The prepared hybrid CLs at these concentrations are optically designed and tested using ZEMAX. Then, the retinal image efficiency is evaluated by modulation transfer function (MTF), spot diagram, encircled energy (EE) and clarity of the formed retinal image.

The results showed that PMMA-TiO_2 is the best CL material and the effect of doping with nanoparticles (NPs) is investigated. Highest n and the best ν_d are obtained at concentration of 0.01 wt/vol. All of the evaluation criteria showed that the eye vision is improved by 0.01 PMMA-TiO_2 CL; where the highest MTF at contrast, highest slope value in the accumulated energy, the smallest spot and the best image clarity are formed on retina.

The well-balanced optical properties of PMMA doped with TiO_2 NPs make it a good candidate for CLs materials because of its effective role in vision improvement and reduce lens dispersion.