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Shear induced fractionalized dispersion during the Magnetic Drug Targeting in a permeable microvessel

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To predict the effective dispersion and saturated concentration of the drug carriers, a Caputo fractional time derivative based dispersion model is generated. The impact of the memory effect dependence of solutions on previous instances on the shear augmented dispersion is analyzed during the magnetic drug targeting in the microvessel. The magnetic nanoparticle are bound with the nonmagnetic materials/microgels with the therapeutic agents to prepare the drug carrier. A magnetic field is created outside the body to control and accelerate the trajectories of the drug carriers. The nature of the blood flow into the vessel is considered as Casson fluid. The velocity of the drug carrier is solved analytically while the fractional-order dispersion equation is solved numerically by using the finite difference method. The influence of fractional-order parameter and model biological parameters such as rheological parameter, permeability parameter related to hydraulic conductivity, magnetization, volume fraction of nanoparticles, tumor-magnet distance, nanoparticle radius, drug elimination, and source term on the relative effective dispersion are discussed. The outcomes showed that both rheological parameters and volume fractions increase drug carrier particle concentration, and that saturating occurs at a later time as they increase. The higher magnetization, the permeability parameter related to the hydraulic conductivity, and the source term, the faster drug-coated carriers are transported to the tumor site. In addition, we indicate that using small particle sizes, a high concentration of the drug-coated nanoparticles will be expected in the tumor area, and this slows the rate at which it reaches the saturation point.

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