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| Abstract |  |
| Transport phenomena with fluid flow, heat, mass, nanoparticle species and microorganism transfer external to a needle in a porous medium have many biomedical engineering applications (e.g. hypodermic needles used in hemotology). It is also used to design many biomedical engineering equipment's and coating flows with bio-inspired nanomaterials. Coating flows featuring combinations of nanoparticles and motile micro-organisms also constitute an important application area. A model for convective flow of a power-law nanofluid containing gyrotactic micro-organisms past a needle in a Darcy porous medium is developed. Multiple slips and Stefan blowing effects at the needle boundary are considered. The model features a reduced form of the conservation of equations with appropriate coupled boundary conditions. The governing equations are converted to similarity equations using appropriate invariant transformations. The transformed equations have been solved numerically using the in-built Matlab bvp4c function. The influence of the emerging parameters on the flow characteristics, friction, heat, mass, and micro-organism transfers are discussed in detail. Note that velocity decreases whilst temperature, concentration, and density of motile micro-organism increase with an increase in blowing parameter for shear thinning, Newtonian, and shear thickening fluids. All physical quantities are decreasing with increasing blowing, Darcy, power law and needle size parameters. | |