**Taylor Dispersion in Pulsatile non-Newtonian Fluid Flow in a Tube with Wall Absorption**


# Abstract

The objective of this study is to explore the different physiological processes involved in solute dispersion in blood flow by using relevant non-Newtonian fluid models. Specifically, we analyze the axial solute dispersion process in both steady and unsteady non-Newtonian fluid flow in straight tubes with absorption at the tube wall. The pulsatile nature of blood is taken into account in the analysis of unsteady flow. Earlier studies investigation is limited to Gaussian solution of the Newtonian/non-Newtonian models, it is thought of investigating the solute dispersion that resulted in non-Gaussian solution by multiple methods (method of moments or Aris-Barton approach, Gill's method or generalized dispersion model and Numerical method) and several non-Newtonian fluid models such as the K-L model, Casson model, Carreau Yasuda model, Carreau model, Bingham model, Hershel Bulkley model, simplified Cross model, power law model. Higher moments provide more precise information regarding the unsteady solute dispersion in the flow field, whether it is Newtonian fluid or non-Newtonian fluid. The present investigation is a possible initiation in investigation of higher order moments for the unsteady solute dispersion in pulsatile Newtonian and non-Newtonian flows. The time dependent data of the exchange, convection, and dispersion coefficients all together does not provide the complete information about the unsteady solute distribution in any fluid flow. Also, several of the earlier published studies are limited to the steady state solutions. With the advent of computational skills, one can investigate the unsteady flows considering the small time and the large time behavior. So the research theme is planned considering these view points. We determine the three transport coefficients (exchange, convection, and dispersion coefficients) as well as skewness and kurtosis- which describe accurate solution of the entire dispersion process in the system. Additionally, we analyze the mean concentration and concentration contours of solute at all times, taking into account the effect of the yield stress, wall absorption parameter, amplitude of fluctuating pressure component, Womersley frequency parameter, Weissenberg number, power-law index, Yasuda parameter, Schmidt number, and Peclet number on the dispersion process. To have a better understanding of the solute dispersion in the tube, the flow and dispersion regimes are derived here moments considering the limiting behaviour of the Womersley frequency parameter and the Peclet number.



**Keywords:** Solute dispersion, Non-Newtonian fluid, Blood rheology, Pulsatile flow, Wall absorption, skewness, kurtosis, non-Gaussian solution, Method of moments, Generalized dispersion model