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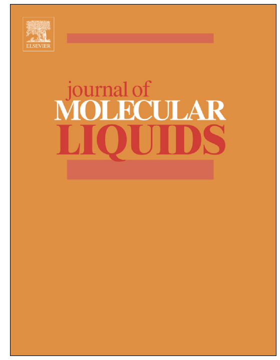

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Consequences of variable thermal conductivity and activation energy on peristalsis in curved configuration

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Abstract: Here peristalsis of non-Newtonian liquid in presence of heat and mass transfer is examined. Mathematical formulation is developed in view of viscous dissipation, variable thermal conductivity and activation energy. Lubrication approach is adopted to retain mathematical modelling in tractable form. Series solution via small Weissenberg is obtained for momentum equation while temperature and concentration equations are solved numerically via built-in shooting technique. The obtained series solutions for pressure gradient, pressure rise per wavelength, stream function, velocity and numerical solutions for temperature, concentration and rates of heat and mass transfer are validated via graphical presentations. Discussion is made in detail. It is observed from the graphical results that pressure rise per wavelength and pressure gradient has opposite behavior for Wessienberg and Johnson-Segalman fluid slip factor parameters. It is reported that due to increaseing impact of activation energy parameter concentration enahnces whereas opposite impact of chemical reaction parameter on concentration is noted.

Keywords: Peristalsis; Johnson-Segalman fluid; Variable thermal conductivity; Activation energy; Curvature effects;

Nomenclature

$(\bar{V}_1, \bar{V}_2)$	Velocity components in fixed frame	ξ	Material slip factor
$(\bar{v}_1, \bar{v}_2)$	Velocity components in moving frame	$\bar{\mathbf{D}}$ and $\bar{\mathbf{W}}$	The symmetric and skew symmetric tensors
$(\bar{X}, \bar{R})$	Curvilinear coordinates in fixed frame	$\bar{\tau}_{\bar{R}\bar{X}}, \bar{\tau}_{\bar{R}\bar{R}}, \bar{\tau}_{\bar{X}\bar{X}}$	Cauchy stress components in fixed frame
$(\bar{x}, \bar{r})$	Curvilinear coordinates in moving frame	$\bar{S}_{\bar{R}\bar{X}}, \bar{S}_{\bar{R}\bar{R}}, \bar{S}_{\bar{X}\bar{X}}$	Extra stress components in fixed frame
$\bar{t}$	Time	$\bar{\tau}_{\bar{r}\bar{x}}, \bar{\tau}_{\bar{r}\bar{r}}, \bar{\tau}_{\bar{x}\bar{x}}$	Cauchy stress components in moving frame
a_0	Width of channel	$\bar{S}_{\bar{r}\bar{x}}, \bar{S}_{\bar{r}\bar{r}}, \bar{S}_{\bar{x}\bar{x}}$	Extra stress components in moving frame
a_1	Amplitude of wave	k_r^2	The reaction rate
c	wave speed	E_a	The activation energy
$\pm\bar{H}$	Channel walls in fixed frame	k'	Boltzmann constant
$\pm\bar{h}$	Channel walls in moving frame	n	fitted rate constant
T	Fluid temperature	(x, r)	Curvilinear coordinates in dimensionless form
C	Fluid concentration	(v_1, v_2)	Velocity components in dimensionless form

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