

passage channel at all the baffle positions, which is the similar result found by Cheng [8].

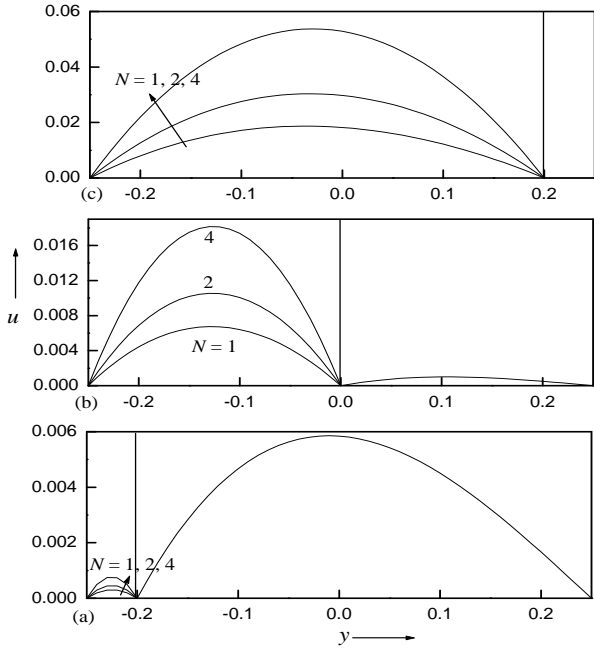


Figure 3: Velocity profiles for different values of buoyancy ratio N at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$

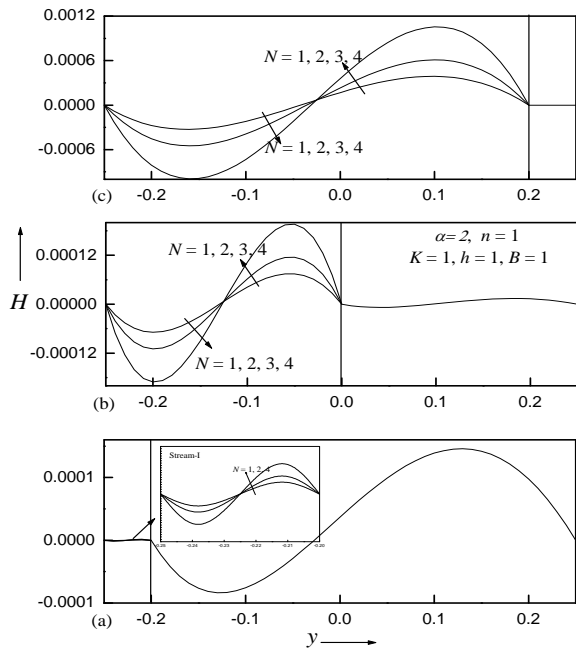


Figure 4: Microrotation velocity profiles for different values of buoyancy ratio N at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$

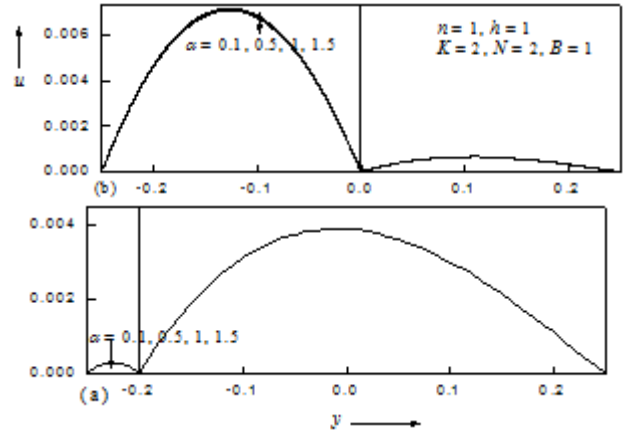
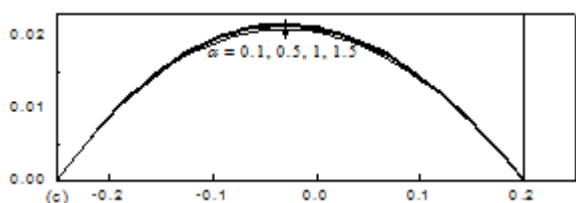


Figure 5: Velocity profiles for different values of chemical reaction parameter α at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$.

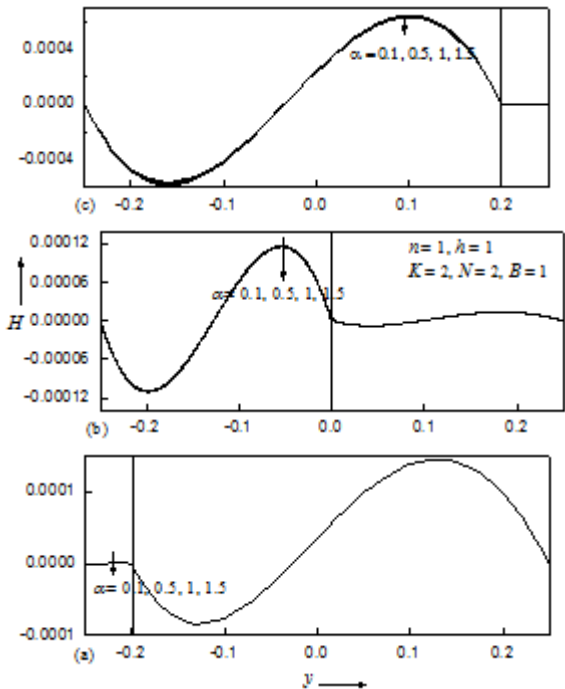


Figure 6: Microrotation velocity profiles for different values of chemical reaction parameter α at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$.

The effect of first order chemical reaction parameter α , on velocity, microrotation velocity and concentration fields are seen in figures 5 a, b, c, 6 a, b, c and 7 a, b, c respectively. As α increases the velocity, microrotation velocity and concentration decreases in stream-I and remains constant in stream-II at all the baffle positions. The similar result was also obtained by Srinivas and Mutturajan [20] for mixed convective flow in a vertical channel. This is due to the fact that the fluid in stream-I is concentrated. The maximum value of velocity and microrotation velocity is seen in stream-II for the baffle position at $y^* = -0.2$ and in stream-I at baffle position at $y^* = 0$ and 0.2 .

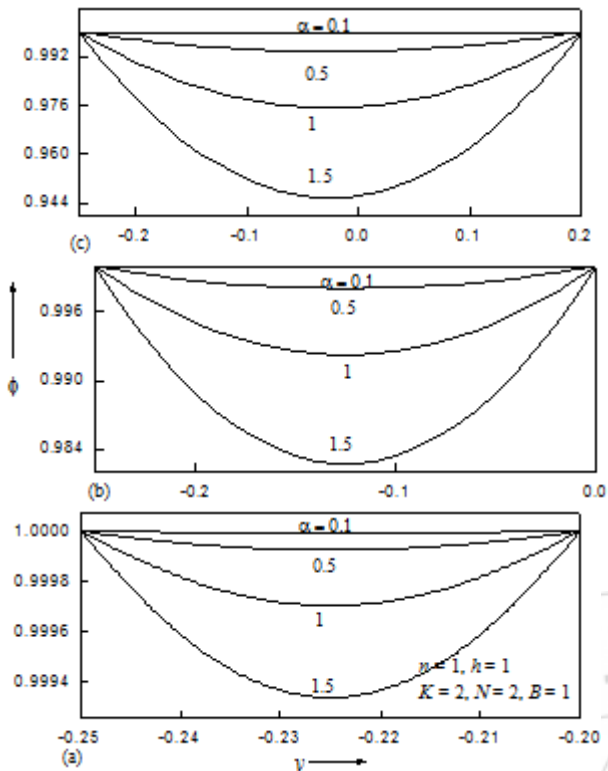


Figure 7: Concentration profiles for different values of chemical reaction parameter α at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$.

Figure 8a, b, c are the plots for the variation of the dimensionless volumetric flow rate Q_v with the buoyancy ratio N for various vortex viscosity parameters $K = 0, 0.5, 1$ and 1.5 , $\alpha = 2, n = 1, h = 1$ and $B = 1$. Increasing the buoyancy ratio tends to accelerate the fluid flow, thus raising the volume flow rate of the fluid flowing through the vertical double passage channel. Moreover, the dimensionless volume flow rate flowing through the vertical channel tends to decrease as the vortex viscosity parameter is increased at any position of the baffle. Figure 9a, b, c shows the variation of the dimensionless total species rate added to the fluid C_s with the buoyancy ratio N for various vortex viscosity parameters $K = 0, 0.5, 1$ and 1.5 , $\alpha = 2, n = 1, h = 1$ and $B = 1$. Increasing the buoyancy ratio accelerates the fluid flow, thus enhancing the mass transfer rate between the wall and the fluid flowing through the vertical double passage channel at all the baffle positions. Moreover, increasing the vortex viscosity parameter tends to decrease the dimensionless total species rate added to the fluid in the vertical double passage channel at all the baffle positions.

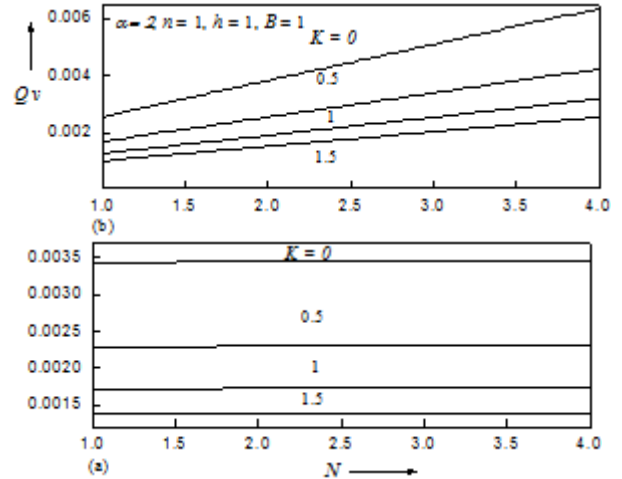


Figure 8: Effect of buoyancy ratio on volumetric flow rate for different values of vortex viscosity parameter at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$.

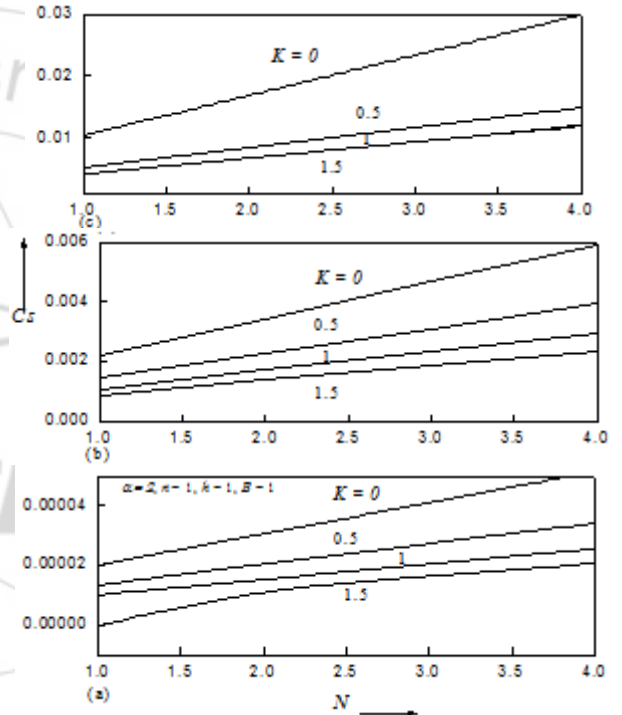
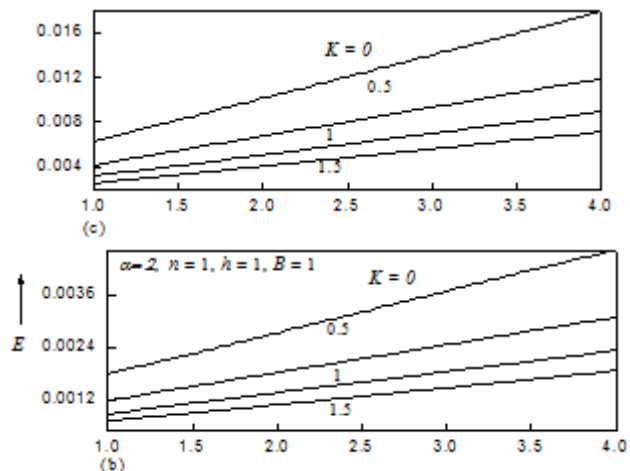
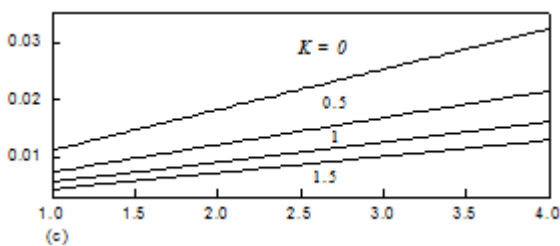


Figure 9: Effect of buoyancy ratio on species concentration rate for different values of vortex viscosity parameter at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$.



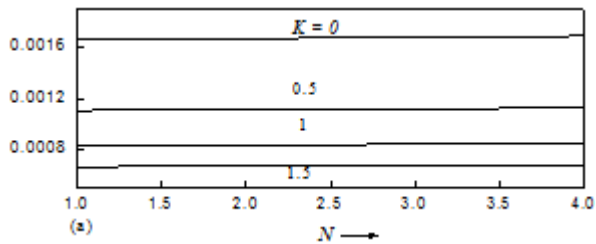


Figure 10: Effect of buoyancy ratio on total energy flow rate for different values of vortex viscosity parameter at (a) $y^* = -0.2$ (b) $y^* = 0$ (c) $y^* = 0.2$.

The dimensionless total heat rate added to the fluid E is plotted as functions of the buoyancy ratio N for various vortex viscosity parameters $K = 0, 0.5, 1$ and 1.5 , $n = 1$, $h = 1$ and $B = 1$, as shown in figure 10a, b, c. Increasing the buoyancy ratio tends to accelerate the fluid flow, raising the heat transfer rate between the wall and the fluid and thus increasing the total heat rate added to the fluid in the vertical double passage channel. However, higher vortex viscosity parameter leads to a decrease in the dimensionless total heat rate added to the fluid in the vertical double passage channel at all the baffle positions.

5. Conclusions

Heat and mass transfer of a chemically reacting micropolar fluid in a vertical double passage channel has been studied analytically and the main findings are:

1. Increase in the vortex viscosity parameter increases the magnitude of microrotation velocity and decelerates the fluid flow in the vertical double passage channel at all the baffle positions.
2. Increasing in the thermal buoyancy ratio enhance the flow in both the streams at different baffle positions.
3. Increase in the chemical reaction parameter suppresses the velocity and temperature in stream-I and remains invariant in stream-II. The chemical reaction parameter suppresses the concentration in stream-I.
4. The use of baffle in the flow channel resulted in the heat transfer enhancement as high as compared to the heat transfer in a straight channel.
5. Increase in the vortex viscosity parameter on the volume flow rate, the total heat rate added to the fluid, and species rate added to the fluid for micropolar fluids are found to be lower than those of Newtonian fluids, which agrees with the results obtained by Cheng [8].

6. Acknowledgement

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