

Question

When you stop to stir your tea, all sugar will concentrate at the center of the bottom of your cup. Why isn't the sugar centrifuged outwards?

Answer



Stirring makes the fluid to rotate at uniform speed (left picture). Sugar is distributed uniformly in the cup.

When you stop to stir two effects are obvious (right picture):

1. Sugar falls to the ground since it is heavier than tea.
2. Rotation of tea is slowed down more strongly at the bottom than at the top because of friction.



As a consequence tea rotates slower at the bottom than at the top, and centrifugal forces at the bottom fall below those at the top. This involves forces that make tea flow down next to the wall and rise again in the center of the cup. Now we have got a flow right above the bottom leading from the outside to the center, which sweeps sugar to the center.