

Abstract for oral presentation

“VPF8 Viscoplastic Fluids: from Theory to Application 2019”

Viscoplastic fluid displacement flows in axially rotating pipes

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In this work, the influence of a pipe axial rotation on buoyant displacement flows of viscoplastic fluids is analyzed via experimental methods. A heavy Newtonian fluid (salt water) displaces a light viscoplastic fluid (Carbopol gel) in a long, inclined pipe. Our experimental results show that the pipe rotation helps break up the Carbopol gel remained on the interior surface of the pipe and induces transverse mixing, which eventually results in a complete removal of the displaced fluid above a critical rotation speed. The study includes the analysis of the penetration front velocity of the heavy fluid into the light one for various flow parameters, such as the pipe inclination angle, the imposed flow velocity and the rotation speed, revealing that the front velocity decreases as the rotation speed increases. Three distinct flow regimes are observed: slump type, ripped type and mixed type. Finally, a criterion based on the dimensionless groups that govern the flow is established to determine efficient and inefficient displacements.