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CFD Analysis of Flow Regimes of Non-Newtonian Liquids in Chemical Reactor

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Abstract : The mixing process is one of the most important and critical stages in many industrial sectors, such as chemistry, pharmaceuticals, and the food industry. When designing equipment with mixing impellers, technology developers often encounter working environments with complex physical properties and rheology. In such cases, the use of computational fluid dynamics tools is an excellent solution to mitigate risks and ensure the stable operation of the equipment. The research focuses on one of the designed reactors with mixing impellers intended for polymer synthesis. The study describes an approach to modeling reactors of similar configurations, taking into account the complex properties of the mixed liquids using the computational fluid dynamics (CFD) method. To achieve this goal, a complex 3D model was created, accurately replicating the functionality of chemical equipment. The model allows for the assessment of the hydrodynamic behavior of the reaction mixture inside the reactor, consideration of heat release due to the reaction, and the heat exchange between the reaction mixture and the cooling medium. The results indicate that the choice of the type and size of the mixing device significantly affects the efficiency of the mixing process inside the chemical reactor.

Keywords : CFD, mixing, blending, chemical reactor, non-Newton liquids, polymers
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