عنوان مقاله:

Coupled Effects of Hub Diameter Ratio and Blade Angle on the Performance of Spiral Axial Flow Gas Liquid Multiphase Pump

محل انتشار:

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خلاصه مقاله:

In pursuit of enhancing the conveying performance of the spiral axial flow gas-liquid multiphase pump, a comprehensive exploration is conducted to unravel the underlying influence mechanism of impeller structural parameters on gas-liquid separation. This study employs the Box-Behnken design, constructing a sample space that encompasses crucial factors such as impeller hub parameters and blade inclination angle, utilizing Computational Fluid Dynamics software to perform numerical simulations of various models within the sample space. Researching the influence of impeller hub diameter ratio and blade inclination angle on the internal flow of a multiphase pump, aiming to determine high-performance parameters under high gas content conditions with the coupled effects of impeller hub diameter ratio and blade inclination angle. The results indicate that the performance improvement becomes more pronounced when the blade inclination angle (γ) is greater than ۲°. For hub structure parameters, the relative size of hub inlet coefficient (kd۱) and hub middle section coefficient (kd۲) is measured using the diameter ratio (kr), where kr ranges from ۰.۹۴ to ۱.۰۲. After optimization, the impeller hub parameters are kd۱ = ۰.۷۷, kd۲ = ۰.۷۶, kr = ۱.۰۱۳, γ = ۶.۹۵. In comparison with the original model, when the Inlet Gas Volume Fraction is ۶۰%, the gas phase aggregation (λ) at ۰.۱Span is reduced by ۴.۵%, the energy dissipation (σ) is decreased by ۵.۳%, and the efficiency and head coefficient are increased by ۲.۳۳۱% and ۰.۰۵, respectively. Therefore, this study has vital theoretical and technical significance for improving the reliability, stability and efficiency of deepwater oil and gas transportation.

کلمات کلیدی:

Spiral axial flow gas-liquid multiphase pump, Hub diameter ratio, blade inclination angle, Gas phase aggregation, Energy dissipation