عنوان مقاله:

Experimental and Numerical Investigation of Coating Effect on Pump Impeller and Volute

نویسندگان:

O. Kocaaslan - ۱Selcuk University, Huglu Vocational School, Huglu-Konya, Turkey

M. Ozgoren - SelcukUniversity, Engineering Faculty, Mechanical Engineering Department, Konya, Turkey

M. H. Aksoy - SelcukUniversity, Engineering Faculty, Mechanical Engineering Department, Konya, Turkey

O. Babayigit - Selcuk University Hadim Vocational School, Hadim-Konya, Turkey

خلاصه مقاله:

In this study, an impeller and volute of a centrifugal pump were designed and numerically analyzed in order to improve the pump efficiency. Before design, experimental and theoretical studies were performed on a centrifugal water pump taken as Model Pump (MP). Design parameters were taken as ۱۰۰ m۳/h for volume flow rate, ۱۸m for head and ۱۴۸۰ rpm for rotating speed. After the inspection of the flow field in the MP, some geometrical modifications such as impeller inlet and outlet diameters, blade inlet and exit angles, blade wrap angle, blade thickness, blade inletand exit widthswere realized to design a new pump. Numerical analyses were performed for ۸ different volume flow rates overlapping with experimental operation points by Ansys-Fluent Software. In numerical studies, k-ε turbulence model and standard wall function were utilized. The experimental and computational results were compared with the model pump. According to the analysis results at design flow rate, hydraulic torque value is decreased from ۵۶.۶۲ Nm to ۵۱.۰۵ Nm, while hydraulic efficiency is increased from ۵۵.۹۸% to ۶۳.۰۹%. In addition, in order to see the roughness effect and increase the pump efficiency, the wetted surfaces of the impeller and volute were coated with a polyurethane dye material. Later, performance curves of the coated and uncoated pumps were experimentally obtained which showed that the shaft power of the pump for the coated case was decreased around ۱۰% and the hydraulic efficiency of the pump was increased approximately ۱۸%. According to the economic analysis by basic payback period of the polyurethane coating is less than one year and the internal income ratio for ten-year life-cycle period is around ۱۱۴%.

کلمات کلیدی:

Centrifugal pump, Hydraulic efficiency, CFD, ε turbulence model, Coating, Polyurethane coating, k, Turbulence Kinetic Energy

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