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旋流泵固液两相流输送特性试验

Performance test on solid-liquid two-phase flow hydrotransport of vortex pump

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英文关键词: [pumps](#) [experiments](#) [efficiency](#) [vortex pump](#) [liquid-solid two-phase flow](#) [NPSH](#)

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中文摘要:

为探索旋流泵输送固液两相流特性,通过分析将泵内部阻力能耗分为机械和流动损失两部分,阐明机械效率 η_m 和流动效率 η_f 经验计算公式。介绍了32WB8-12型旋流泵水力设计结构参数。制定了粮食作物两相流输送试验方案,并在样机上完成输送清水及菜籽、小麦和黄豆两相流外特性试验,得出泵流量-扬程(qv-H)、流量-轴功率(qv-P)、流量-效率(qv- η)和流量-汽蚀余量(qv-NPSHc)性能曲线变化规律。试验结果表明:输送球状菜籽泵效率高于清水和另外两种介质;输送两相流介质抗汽蚀性能低于清水;颗粒浓度不变时,泵的扬程和效率随粒径的增加均有所降低;输送菜籽球体规则形状颗粒介质泵效率高于输送不规则形状颗粒两相流;从颗粒与液流之间直线和旋转相对滑移运动的相对性原理入手,综合考虑介质粒径大小和形状及所受惯性力、摩擦力和浮力对流场影响的特点,解释了外特性与内部流动之间定性的因果关系;证明旋流泵内部两相流动符合畸变速度原理。该研究可为建立旋流泵内部固液两相流动模型提供参考。

英文摘要:

Abstract: In order to study the solid-liquid two-phase flow hydrotransport characteristics of vortex pump, the energy consumption of pump caused by internal resistance is divided into two parts: the mechanical losses and hydraulic losses, also the calculation of mechanical efficiency η_m and hydraulic efficiency η_f is elaborated. This paper investigates the 32WB8-12 vortex pump's parameter of hydraulic design structure. The crops solid-liquid two-phase flow hydrotransport experiment plan is established, meanwhile the performance experiments of clean water, rapeseed, wheat and soya hydrotransport are conducted on a self-built vortex pump, after taking above experiments that the qv-H, qv-P, qv- η , qv-NPSHc curves are obtained. The experimental results indicates the pump's hydrotransport efficiency of spherical rapeseed is higher than clean water's and the others' two-phase flow. The pump anti-cavitations are reduced with the solid-liquid two-phase flow hydrotransport. The head and hydrotransport efficiency of pump ordinarily decrease with increased particle size under the condition of constant particle concentration. Moreover, the hydraulic efficiency of transporting regular sphere shape particles such as rapeseed is higher than the clean water's, wheat's and soya's. The characteristics are considered based on the slip flow with the principle of relativity that sliding liner and rotary motion between particles and fluid flow. Associated with particle's size and shape, the particles suffered inertial force, friction force and buoyant force have significance on fluid field, all above information also proved that internal two-phase flow of vortex pump meet the principle of distortion velocity. From the experimental data analyses, some explanations are given for the link and changing trends between the external characteristics and internal flow nature. This research can provide a reference for building the model of fluid solid two-phase flow in vortex pump.

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