滴灌双向流流道灌水器水力特性分析

Analysis on hydraulic performance of bidirectional flow channel of drip irrigation emitter

投稿时间： 2013-06-28 最后修改时间： 2013-09-17

中文关键词：灌溉,水力学,设计,灌水器,双向流流道,结构参数,水力性能

英文关键词：irrigation hydraulics design emitter bidirectional flow channel structural parameters hydraulic performance

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中文摘要：

　　滴灌双向流流道是一种新型滴灌灌水器流道。为了研究流道结构参数对水力特性的影响，分别以流态指数和流量系数为评价指标，取流道的9个主要结构参数为因素，采用均匀试验设计的方法，安排了12组试验方案。根据试验结果，应用多元回归计算方法，分别建立了流态指数和流量系数与9个结构参数之间的量化关系式，其相关系数分别为0.999和0.998，同时还用另外一组结构参数的试验方案验证了建立的量化关系式。T检验结果显示，9个主要结构参数对流态指数的影响均较显著，而V字形挡水件的张角α对其影响最大；出口宽度a、八字形分水件张角β对流量系数的影响较显著，而出口宽度a对其影响最大，为双向流流道的设计提供了参考。初步研究表明双向流流道的流态指数在0.40～0.47之间，其水力性能优良，结构简单，有一定应用前景。

英文摘要：

　　Abstract: The bidirectional flow channel is a new kind of channel for drip irrigation emitter, it has the advantages of simple structure, easy manufacturing and good hydraulic performance. The main working principle of the bidirectional flow channel is mixing the forward flow and the backward flow to enhance the effect of energy dissipation. The forward flow and backward flow are produced by splayed wall and V-shape wall in the channel. In order to study the effects of structural parameters on hydraulic performances, choosing 9 key factors from the structural parameters and arranging 12 experimental schemes to study flow index and flow coefficient. The experiments can obtain the inlet pressure of channel and the outlet flow rate. Each experimental scheme was set 3 repeats to make sure that the results are accurate. Based on the flux of bidirectional flow channel under different pressures, the flow index and flow coefficient can be obtained by using linear regression, and then regression equations can be built. The regression equations regressed by the multivariable regression method about flow index and flow coefficient to 9 structural parameters have the higher relativity, the correlation coefficients are 0.999 and 0.998. The regression equations are verified by another experimental scheme which number is 13. The results showed that the regression equations are reliable and accurate. The flow index of bidirectional flow channel is in the range from 0.40 to 0.47, whose hydraulic performance is good. According to the t-test analysis, all of the 9 structural parameters are the important factors to the flow index at the 0.05 significance level, in which α, the field angle of V-shape wall is the most important factor, and followed by c, the distance between the vertex of V-shape wall and the medial of the side wall at the outlet; d1, the distance between the both sides of V-shape wall and the side wall of channel; β, the field angle of splayed wall; b, the width of inlet; d4, the distance between the vertex of V-shape wall and the vertex of splayed wall; d3, the width of the middle orifice of splayed wall; a, the width of outlet; d2, the distance between the both sides of splayed wall and the side wall of channel. There is a negative correlation between d1, a, b, β, c and flow index, while there is a positive correlation between other four factors and flow index; the outlet width and the field angle of splayed are the important factors to the flow coefficient, while the outlet width is the most important factor, there is a positive correlation between these two factors and flow coefficient. These conclusions can provide an evidence for designing bidirectional flow channel and make the hydraulic performance of the new channel better.

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