Designing Water Inter-Plant Networks of Single and Multiple Contaminants through Mathematical Programming	
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Abstract: Water is the meaning of life for humans, agricultural and industrial processes; controlling the distribution of water and wastewater between industrial processes is very vital for rationalizing water and preserving the environment. This paper addresses a mathematical approach to optimizing water inter-plant networks. The water network problem is formulated as a nonlinear program (NLP) that is solved by LINGO Software, version 14.0. A generalized two-step mathematical model is designed to be valid for solving networks containing large numbers of sources and sinks. The introduced model is proposed to be used for both single and multiple contaminant problems with up to six contaminants. Two mathematical models are presented to design water inter-plant networks efficiently. Firstly, the introduced model is solved by LINGO, in which the data given are applied; the obtained results are simultaneously sent to a second model (based on Excel Software 2019, v. 16.0), by which the obtained water networks are automatically drawn. The proposed approach has been applied in three case studies; the first case study contains five plants of single contaminants, the second case study contains three plants of single contaminants, and the third case study contains three plants of multiple contaminants. The results showed a noticeable reduction in the percentages of freshwater consumption in the investigated three case studies, which were 38.6, 4.74 and 8.64%, respectively, and the wastewater discharge of the three case studies were decreased by 38.1, 4.61 and 8.65%, respectively.

هـ-خوجه