The graphic method for simultaneous optimization of heat-integrated water networks with single-contaminant using reused water

R. Shen*¹, M. Jian¹, Z. Yu²

¹School of Chemical Engineering & Technology, Xi'an Jiaotong University, China
²Xi'an Jiaotong University, China

Abstract

Water and energy resources are of great importance to industrial production, but now their reservation are becoming more and more short under advanced development of industry and increasing scale of population. The demand of reducing energy and water consumption is a critical issue in various industrial sectors especially in chemical engineering industry. This paper introduces a regeneration process of wastewater into heat-integrated water networks with single contaminant, and aims to improve the graphic method using temperature-concentration diagrams. The design method for heat-integrated water networks proposed in this paper takes wastewater regeneration recycle and the regeneration reuse into consideration. The research is implemented by designing water networks for regeneration unit and designing the overall water networks, and then obtains a heat-integrated water networks considering wastewater regeneration through designing of heat exchange network. Find the water pinch of the regenerated and circulated water system to optimize the regenerated union-strucure as well as the whole system in consideration of the heat integrated process. Comparing to eariler method, this method reduces the water consumption from 90 kg·s⁻¹ to 20 kg·s⁻¹, and the minimum heating utility from 4165 kW to 1929 kW. The optimization proposed in this paper helps to reduce water and energy consumption in a big quantity which can provide a reference to practical process of engineering. Besides, it is concluded that the improved method of wastewater regeneration recycle temperature-concentration diagrams is better than improved method of wastewater regeneration reuse temperature-concentration diagrams.