Water System Optimization in Coal-based Chemical Complex

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Abstract

Coal chemical industry is of high water consumption that has become the bottleneck for sustainable development of coal-based chemical industry. Therefore, the efficient utilization of water and less wastewater discharge is required. The stringent environmental regulations and also the escalating cost of freshwater as well as wastewater treatment have motivated the process and manufacturing industries to emphasis on fresh water and waste minimization in their daily operations. In particular, optimal design and retrofit of industrial water system provides a systematic approach for freshwater conservation. Conventional water system optimization often only considers flowrate of fresh water, but ignores flowrates of desalted water, steam and condensate water. The relationship between those types of water is lack of analysis. The minimum freshwater flowrate for the whole water system cannot be determined in one step via the conventional water system optimization model. In order to overcome such a limitation, this paper proposed a general model of water-using process including more water types, and presented a general superstructure of water system optimization for a coal-based chemical complex. The material balance equations that relate all types of water are integrated in the model. The commercial software, GAMS, is used for modelling and solving a water system for a certain large coal-based chemical plant. Case study shows that the freshwater flowrate for the whole coal chemical plant can be calculated effectively via the proposed optimization model and it demonstrate the applicability of the model.