

TARGETING FOR TOTAL WATER NETWORK BASED ON PINCH ANALYSIS

Denny Kok Sum NG, Dominic Chwan Yee FOO

School of Chemical and Environmental Engineering, University of Nottingham Malaysia
Broga Road, 43500 Semenyih, Selangor, Malaysia.

Raymond R. TAN

Chemical Engineering Department, De La Salle University-Manila, 2401 Taft Avenue,
1004 Manila, Philippines.

Yin Ling TAN

School of Engineering and Science, Curtin University of Technology
Sarawak Campus Malaysia, 98009 Miri, Sarawak, Malaysia.

ABSTRACT

The current drive towards environmental sustainability and the rising costs of fresh water and effluent treatment have encouraged the process industry to find new ways to reduce fresh water consumption and wastewater generation. Process plants are now taking more serious measurement towards the minimisation of fresh water consumption via in-plant water reuse/recycle. This corresponds to reduced effluent generation as a mean to reduce production cost and to ensure sustainable growth in the business activities. The advent of process integration tools for the synthesis of optimal water network has seen extensive progress over the last decade, especially in the area of water reuse/recycle (Wang and Smith, 1994; Dhole *et al.*, 1996; Polley and Polley, 2000; Hallale, 2002; El-Halwagi *et al.*, 2003; Manan *et al.*, 2004; Prakash and Shenoy, 2005, Foo *et al.*, 2006).

To date, flowrate targeting for water reuse/recycle based on pinch analysis techniques has been rather established. In this work, a novel and non-interactive numerical technique for flowrate targeting in a total water network is presented. A total water network consists of water reuse/recycle, regeneration as well as wastewater treatment networks (Bagajewicz,

2000; Gunaratnam *et al.*, 2005). Apart from fresh water and wastewater flowrate targets, this newly proposed method allows the simultaneous targeting of regeneration and wastewater flowrates for final treatment. A revised cascade analysis technique known as Regeneration Water Cascade Analysis (RWCA) based on the work of Manan *et al.* (2004) is used to locate the various total water network targets. Two literature examples involving fixed-load and fixed flowrate problems are solved to illustrate the applicability of the newly developed technique.

REFERENCES

1. Bagajewicz, M. (2000). A Review of Recent Design Procedures for Water Networks in Refineries and Process Plants. *Computers and Chemical Engineering*. 24: 2093-2113.
2. Dhole, V. R., Ramchandani, N., Tainsh, R. A. and Wasilewski, M. (1996). Make Your Process Water Pay for Itself. *Chemical Engineering*. 103: 100-103.
3. El-Halwagi, M. M., Gabriel, F. and Harell, D. (2003). Rigorous Graphical Targeting for Resource Conservation via Material Recycle/Reuse Networks. *Industrial & Engineering Chemistry Research*. 42: 4319-4328.
4. Foo, D. C. Y., Manan, Z. A. and Tan, Y. L. (2006), Use Cascade Analysis to Optimize Water Networks, *Chemical Engineering Progress*, 102(7): 45-52 (July 2006).
5. Gunaratnam, M., Alva-Argáez, A. Kokossis, A. Kim, J.-K. and Smith, R. (2005), Automated Design of Total Water Systems. *Industrial & Engineering Chemistry Research*. 44: 588-599.
6. Hallale, N. (2002). A New Graphical Targeting Method for Water Minimisation. *Advances in Environmental Research*. 6(3): 377-390.
7. Manan, Z. A., Tan, Y. L. and Foo, D. C. Y. (2004). Targeting the Minimum Water Flowrate Using Water Cascade Analysis Technique *AIChE Journal*. 50(12): 3169-3183.
8. Polley, G. T. and Polley, H. L. (2000). Design Better Water Networks. *Chemical Engineering Progress*. 96(2): 47-52.

9. Prakash, R. and Shenoy, U. V. (2005a). Targeting and Design of Water Networks for Fixed Flowrate and Fixed Contaminant Load Operations. *Chemical Engineering Science*. 60(1): 255-268.
10. Wang, Y. P. and Smith, R. (1994). Wastewater Minimisation. *Chemical Engineering Science*. 49: 981-1006.