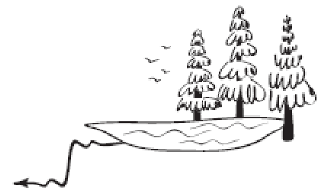
ENVIRONMENTAL FOOTPRINT COMPARISON TOOL

A tool for understanding environmental decisions related to the pulp and paper industry



H2O

EFFECTS OF DECREASED RELEASE OF CHLORINATED COMPOUNDS ON WATER USE

Impact of Reuse and Recycle of Bleach Plant Filtrates

The notion of a “zero-effluent bleach plant” has been the Holy Grail of environmentally motivated process changes sought at bleached chemical pulping operations. Among the benefits giving impetus to that quest are

1. reducing the volume of mill process water requirements and the associated hydraulic load on wastewater management systems;
2. reducing the organic load imposed on wastewater treatment operations and subsequent discharges to receiving streams; and
3. eliminating the discharge of chlorinated organic compounds.

The accumulation of chloride ions in mill processes can be a key obstacle to reusing bleach plant filtrates. Thus, eliminating the use of chlorine-based bleaching agents is often perceived to be the most direct path to collectively achieving these ends by virtue of enabling greater recirculation of bleach plant filtrates. Chlorine-based bleaching agents, however, are not the only source of troublesome chloride ions that accumulate in recirculated process streams, nor are chlorides the only inorganic substances that can be problematic in closed water systems. The progressive closure of bleach mill water systems, regardless of bleach sequence, invites a number of operational issues:

1. the increased concentrations of organic and inorganic compounds resulting in increased corrosion, scaling, and deposition within the bleach plant and other mill areas;
2. the accumulation of dissolved solids that cause a considerable increase in the consumption of bleaching chemicals;
3. difficulty in reaching target brightness, particularly for peroxide bleached pulps;
4. variable pulp quality, particularly for TCF pulps;
5. increased likelihood of precipitation of calcium oxalate (CaC_2O_4), calcium carbonate ($CaCO_3$), and barium sulfate ($BaSO_4$); and
6. the possibility that additional evaporation plant capacity and additional recovery boiler capacity may have to be installed (STFI 2003 as cited in AMEC 2006).

Of particular interest here is the extent to which the closure of mill water systems impacts bleaching chemistry in ways that affect pulp bleachability or increase chemical requirements.

For elemental chlorine free (ECF) mills, the prime concern associated with bleach plant filtrate recirculation has been the build-up of chloride in the chemical recovery cycle, with secondary concerns related to pulp quality and mill operability. For totally chlorine free (TCF) mills, however, the prime concern has been pulp quality (strength and brightness) with secondary concerns in operability, and potassium and chloride build-up in the recovery system. Both ECF and TCF bleach plant closure can cause operating difficulties with increased chemical consumption, poorer pulp quality, and challenges in minimizing deposition and scaling on equipment (AMEC 2006).

Currently, ECF effluents can be recycled to chemical recovery, but only when there is provision made for increased chloride removal from the chemical recovery system. This, as might be expected, is due to the build-up of chloride ions (Cl^-) and in some cases potassium (K). Given that TCF bleach effluents contain virtually no chloride, the problems associated with chloride are less than those in ECF bleaching, but in general, increased purging is also required due to accumulation of other dissolved substances that are problematic (Gleadow et al. 1996).

Both ECF- and TCF-based bleaching strategies are compatible with a high degree of system closure. With the development of new technologies and the concept of alkaline stage recovery, ECF is being seen by some as the more compatible. The main reason is that chlorine dioxide bleaching is less sensitive to the build-up of organics and metals in highly closed water recycle circuits compared to ozone and peroxide bleaching. Based upon current knowledge, the degree of closure in TCF operations can be only partial, whereas ECF mills are more likely to operate fully closed. There are, however, no bleach plants in papergrade bleached kraft mills that operate fully closed on a continuous basis.

Much of the technology development associated with kraft mill bleach plant closure has involved extensive water use reduction and has been accompanied with a concurrent need for understanding and managing the impact of contaminant build-up in mill water systems. This has meant focusing on mitigating undesirable consequences such as scale deposits, corrosion, loss of bleaching efficiency, increased evaporative loads, reduced production capacity, and loss of operational flexibility. These issues have caused many companies to reconsider the role of process closure in minimizing effluent impacts. In many cases, the optimal solution has been found to be a high degree of closure, down to 15 m^3/ton, coupled with external biological treatment of the remaining process effluent (Stratton, Gleadow, and Johnson 2005).

References

AMEC Ltd. 2006. *Study report for review of ECF and TCF bleaching processes and specific issues raised in the WWF report on Arauco Valdivia*. Melbourne: Beca AMEC Ltd. http://s3.amazonaws.com/zanran_storage/www.aet.org/ContentPages/2827017.pdf

Gleadow, P.L., Vice, K., Johnson, A.P., Sorenson, D.R. and Hastings, C.R. (1996). Mill applications of closed cycle technology. In *Proceedings of the 1996 TAPPI International Non-Chlorine Bleaching Conference*. Atlanta, GA: Tappi Press.

Stratton, S., Gleadow, P., and Johnson, A. 2005. Pulp mill process closure: A review of global technology developments and mill experiences in the 1990s. *Water Science & Technology* 50(3): 183-194.

Swedish Pulp and Paper Research Institute (STFI). 2003. *Ecocyclic pulp mill – "KAM" – Final report 1996–2002*. KAM Report A100. Stockholm: Swedish Pulp and Paper Research Institute.