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Straight talk on sustainability.

Pulp Bleaching

Verso Paper Corp.'s Position

Based on peer-reviewed studies and extensive real-world experience, Verso Paper Corp. agrees with the U.S. Environmental Protection Agency that elemental chlorine-free (ECF) bleaching is a "best available technology" for pulp bleaching. We use an enhanced ECF bleaching process at our two kraft pulp mills in Jay, Maine, and Quinnesec, Mich.

Background

As part of the kraft pulping process, wood pulp fibers are bleached before papermaking to give end products a bright, white appearance and prevent them from yellowing.

The U.S. Environmental Protection Agency (EPA) recognizes elemental chlorine-free (ECF) bleaching as a "best available technology." Verso adds either oxygen delignification or extended delignification processes to enhance elemental chlorine-free (ECF) bleaching in its two kraft pulp mills. This reduces the amount of bleaching chemicals needed. Verso replaced elemental chlorine (chlorine gas) with elemental chlorine-free bleaching processes at its mills years ago after extensive research and real-world results in the United States and abroad clearly demonstrated that ECF bleaching eliminates the formation of dioxin and other persistent chlorinated organics that were produced by elemental chlorine bleaching.

Using the EPA's approved analytical methods, dioxin and other chlorinated organic chemicals are not detected – even at parts per quadrillion – in the wastewater at Verso's mills.

The Chemistry of ECF Pulp Bleaching

Since both contain chlorine atoms, how does the chlorine dioxide used in elemental chlorine-free bleaching eliminate the formation of dioxin and other persistent chlorinated organic chemicals that result from elemental chlorine bleaching? A simple chemistry review provides the answer.

Elemental chlorine gas, which was banned for use in pulp bleaching by the EPA's Pulp and Paper Cluster Rules in the late 1990s, is made up of two atoms of chlorine. Chlorine dioxide is made up of one chlorine atom and two oxygen atoms. During the chlorine gas bleaching process, elemental chlorine atoms combine with lignin (the organic glue that holds wood fibers together) in a *substitution reaction* that creates a very small amount of chlorinated organic compounds like dioxin.

The chlorine dioxide currently used in ECF bleaching works in an *oxidation reaction* that breaks apart the lignin molecules that would otherwise serve as the precursors to dioxins and other chlorinated organics, leaving behind water-soluble organic compounds that are very similar to those occurring naturally in the environment. The chlorine atom in the chlorine dioxide leaves the bleaching process as a chloride – salt.

The ECF process is now the global standard for chemical pulp bleaching and is used to make 75% of chemically produced pulp worldwide. About 20% of pulp is

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produced using varying degrees of chlorine dioxide substitution, with 5% using totally chlorine-free (TCF) bleaching.

Advantages of Elemental Chlorine-free Bleaching

Some would argue that environmental responsibility demands the elimination of all chlorine-containing compounds from pulp bleaching. The basic chemical reaction described above demonstrates the fallacy of this argument. Not only is elemental chlorine-free bleaching safe, it is environmentally superior to totally chlorine-free bleaching for a variety of reasons:

1. ECF bleaching uses chlorine dioxide rather than the more fiber-destructive ozone used in TCF bleaching.
2. ECF bleaching yields 3% to 10% more pulp than TCF bleaching, making more efficient use of wood resources.
3. ECF bleaching produces stronger fibers that can be recycled more times than TCF fiber.
4. ECF paper may include post-consumer content, but TCF paper cannot because it is impossible to determine what process was used to bleach the recovered fiber.

For more information on pulp bleaching or other sustainability issues, please call Verso's Office of Sustainability at 901-369-4154 or visit www.versopaper.com/sustainability.