EFFECTS OF DECREASED WATER USE ON ODOR

Odor in the Finished Product

Robertson (2006) provides a brief overview of odor sources from finished products. Other good reviews of odors in final product are contained in Wiik and Helle (1998) and Pugh and Guthrie (2000).

Volatile Fatty Acids

Volatile fatty acids (VFAs) are a microbial odor source at mills, especially closed recycled boards mills. VFAs are produced by anaerobic bacteria during fermentation. The most common VFAs are acetic acid, propanoic acid, butyric acid, valeric acid and is-valeric acid. Nalco has reported that mills with VFA concentrations exceeding 700-1000 ppm are among most problem cases. Butyric, propanoic, and valeric acids can cause odor problems even at low concentrations. VFAs are found in the finished product, at the clarifier and dryer vents. They can be found in paper machine areas that have stagnant conditions and high nutrient loadings such as broke, coated broke, and starch chests. Fatty acids only become an odor problem if they are volatilized. The volatile form of VFAs is the uncharged, molecular form. The acid dissociation constant (pKa) values of some of the carboxylic acids are given in Table W19. The carboxylic acids in Table W19 dissociate in pH range of 3-5, so more alkaline pH levels favor decreased volatilization. Anaerobic bacteria, on the other hand, favor neutral to alkaline conditions.

Table W19. Dissociation Constants of Carboxylic Acids at 0.1 m Ionic Strength, Equilibrium Constants Valid at 25°C (values taken from Robertson 2006)

Compound	$\log_{10}K$
Formic	3.752
Acetic	4.756
Glycolic	3.831
Propanoic	4.874
Butanoic	4.817

Hydrogen Sulfide

Hydrogen sulfide can be a byproduct of anaerobic activity in pulp and paper mill process waters. The human nose is sensitive to hydrogen sulfide levels at concentrations of less than 1 ppm and thus, at low concentrations, its presence can be a nuisance. At high concentrations, hydrogen sulfide can be toxic and explosive so it is important to control the potential for its formation in process waters.

Musty Geosmin

Humans can detect geosmin and MIB (2-methylisovorneol) levels as low as 4 and 9 nanograms per liter, respectively. These compounds are associated with “earthy” or “musty” odors. Geosmin and MIB are metabolic by-products of “mold-like” filamentous bacteria and blue-green algae and are released into the water upon the death of these organisms. Geosmin and MIB may be formed in wastewater treatment systems and can be generated in paperboard when mills reuse a portion of their activated sludge in pulp furnish.

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Non-Microbial Fatty Acids

Unsaturated fatty acids may oxidize to volatile odor-causing compounds having a paint-like or rancid smell. Thoroughly washing pulps minimizes the rancid odor problem, but pulp storage increases the auto-oxidation process. Hexanal, an example of a compound that can result from the auto-oxidation process, has a grassy, fruity, or green smell and can be a problem in some paper products.

References

Pugh, S. and Guthrie, J.T. 2000. Development of taint and odour in cellulosic carton-board packaging systems. *Cellulose* 7:247-262. http://dx.doi.org/10.1023/A:1009222410875

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