Journal of Korea Tappi
Vol. 29, No. 1, 1997
Printed in Korea

SLIME CONTROL

슬라임 콘트롤

Mike Stanbrough
Nalco Pacific, U. S. A

Forward

Paper systems by nature are fairly ideal locations for the growth of microbio slime. The presence of food, moisture and temperature suit many microbiological organisms. In addition, the chemistry of the systems on occasion will be suitable for the formation of chemical slimes. It is the formation of these types of deposits which often times leads to down time in paper systems. Down time is lost time and lost times equals lost profits.

Deposits

To review for a moment. Paper system deposits generally can be broken into three basic categories. Often times deposits are combinations of two or three of the followings : —

- ◆ Organic—Pitch
- ◆ Inorganic—Scale
- ◆ Microbiological—Slime

Most slime can further be broken down into chemical or microbiological.

Chemical Slimes

We will briefly state that most chemical slimes are found in acid systems which use large amounts of alum. At low pH, around 4.0, a significant portion of the alum will exist in a soluble state. If exposed to a pH shock such as a fresh water addition point, the soluble alumina deposit out as a alumina hydroxide gel. The exception to this might be a chemical slime caused by improper application of a system additive. Typically these will be found close to the addition point.

Microbiological Slime

The test of this presentation will deal with microbiological slime. We will cover associated problems, identification and control.

Problems Caused By Slime

Uncontrolled growth of microbiological organisms can cause all of the following conditions to occur: —

- ● Sheet breaks
- ● Holes
- ● Discoloured spots in the sheet
- ● Paper which has a bad odor
- ● System corrosion
- ● Additives which lose activity
- ● Production problems due to plugging of showers, filters, wires, felts and control devices
- ● Stock losses especially during shutdowns
- ● Safety problems due to gas formation, slippery floors and hazardous work conditions

Acid Versus Alkaline

About the only difference which can be noted in these two systems is the absence of alumina deposits found in alkaline paper systems.

All of the following deposits are found in both acid and alkaline systems:—

- Scales
- Filler and fines generally associated with slime or pitch
- Pitch be it related to pulp, additives, coatings or recycled fiber
- Microbiological

Levels Of Concern

Since it is technically and economically impossible to run a sterile stock system, we generally become concerned only when the levels of microbio activity exceeds certain levles. These activity levels are established by experience and observations made over many years and cover hundreds of paper systems. They are not exact but are generally useful as guidelines. We have found that when microbio levels are below the following levels, slime problems tend to be minimal:—

Organisms	*Number per all of sample*
Molds	Less than 100
Yeasts	Less than 1,000
Bacteria	Less than 1,000,000

Microbiological Types

Slime forming microbiological organisms which cause problems in paper systems typically can be broken into three broad classifications, they are molds, yeasts and bacteria.

Bacteria can be further broken down into aerobic, anaerobic and aerobic spore formers.

Aerobic Bacteria

Aerobic bacteria require oxygen to grow. This oxygen is readily found in the process waters. They form the soft gelatinous slimes found in many paper systems and are the most common and numerous organism found. We will often find all of the following aerobic bacteria in a proper system analysis:—

- E Coli
- Rough and regular mucoids
- Aerobacter
- Flavobacterium

Anaerobic Bacteria

Anaerobic bacterial grow in the absence of oxygen. These organisms are generally found in systems with long standing persistent deposits. If you have ever scrapped a slime deposit off a paper machine and observed a black stinky layer at the base of the deposit, you have observed anaerobic bacteria at work. In addition to causing corrosion, these organisms produce gases which are not only toxic but also explosive. Two common classifications are sulfate reducers and clostridium.

Aerobic Spore Formers

Aerobic spore formers also require oxygen to grow. These little fellows in addition to forming slime masses also throw off spores (eggs). The spores are difficult to control, and can end up

in the sheet as part of the finished product. Papers used for food packaging especially dairy products generally have limits set as to the number of allowed spores per unit of paper. Spores also cause odor and spots in finished product especially if stored in warm humid conditions. Two common spore formers found in paper systems are B Cereus and B Subtilis.

Fungi

Fungi are generally broken into two classifications. They are molds and yeasts. Both of these organisms are known to cause paper system microbio problems. Molds form tough stringy deposits which can result in rather large defects in the sheet. Yeasts are expecially common in coatings and starch systems. The strong odor noted in some starch holding tanks is directly due to yeast fermentation. Typical yeast strains found in paper systems include saccharomyces, rhodatorula and torula.

Fresh Water Organisms

Fresh water, the largest raw material used in paper making, is often times the primary and most important contributor to slime problems. If fresh water organisms such as filamentous bacteria or protozoa are found in a system deposit, there is a very good chance that mill water treatment such as chlorination is not up to standards. Some common fresh water organisms which are easily identified are as follows:—

- ◆ Sphaerotilius & Gallionella — A filamentous iron bacteria
- ◆ Beggiatoa — A filamentous sulfur bacteria
- ◆ Protozoa — Free swimming organisms
- ◆ Nematodes — Worm—like organisms
- ◆ Algae — Filamentous or single celled, often green
- ◆ Diatoms — Algae with a silicified skeleton

All of the above organisms are easily eliminated by the addition of low levels of chlorine or biocide. If they are found it is usually a good indication of a system which is totally out of control.

Methods Of Enumerating Bacteria

Routine measurement of the bacteria levels is normally performed to monitor system conditions, some of the more commonly used methods are listed as follows:—

- ◆ Total plate count
- ◆ Easicults
- ◆ Biometer (ATP)
- ◆ Millpore filters
- ◆ Haemocytometer
- ◆ Quick Count

The author of this paper still believes that for routine measurement, total plate counts still are preferred. Every year or so, a new revolutionary analytical method for measuring bacteria is introduced. For the most part, these analytical methods will find a specific application such as a gross contamination identification, or quick and easy but not accurate monitoring. As yet we do not believe that any of the "break—throughs" for identifying and enumerating bacteria are either accurate or reliable.

Recommendations

If a microbiological slime problem is suspected, the following steps will help in eliminating this condition:-

1. Consider partnering with a qualified supplier.

2. Determine the nature and scope of the problem by doing a system survey. The survey should include all of the following:-

- ◆ Microbiological analysis
- ◆ Chemical analysis
- ◆ Flow diagrams
- ◆ Furnish data
- ◆ System characteristics

3. Identify the problem specifically-determine if the deposit is microbial, chemical, scale or pitch in origin.

4. Determine the economic impact of the conditions. Spell out in specific details the associated costs. Calculate an ROI to be gained by elimination.

5. If the condition is clearly identified as microbio slime, you will need to perform a mill wide microbio survey. That will be followed by a biocide screening to select the best treatment program. Once treatment is initiated, you will need to run cycle analysis to determine program effectiveness.

6. To establish your initial program and to insure effective and economical results, you need to use a combination of activities. The most effective programs include all of the following:-

A) Routine boil outs

B) Good housekeeping practices

C) Effective chemical treatment

D) Effective mill water chlorination

7. Establish an on-going monitoring program to use as a base line for program modifications. Confirm that the results obtained meet your original expectations.

Cautions

A. Proprietary chemistries should not be applied without strict safety precautions.

B. Improper application can result in either very high costs or very ineffective results.

C. Improper application can result in sizing, odor, strength, foam and other process problems.

Conclusion

Paper system deposits be they slime, pitch or scale can and do cost valuable process dollars. These conditions can be controlled and chemicals are often times justified. The most effective control is obtained when all of the processes are considered. A complete and wide spread investigation is required to find the root cause. These investigations often require the assistance of specialists which are not readily available in most mills. The most cost effective solutions are generally obtained when a partnership is formed between the customer and a qualified supplier. Continued performance and cost control is the responsibility of both partners.