Paper Odour Problem- Maxim's Innovative Solutions

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Abstract

The demand for packaging paper is on the rise across the globe resulting in many Indian mills getting an opportunity to export its paper to meet that demand. Howeverthe export quality needs to meet stringent quality regulations and hygienic odor norms as per international standards. The paper intended for food packaging and personal use should be low in Odor to avoid tainting. Microbial activity under anaerobic conditions may cause odour problem in mills with closed water systems or mills using recycled paper. The addition of good biocides, odour control chemicals and good water circulations can reduce the problem.

Major contributory ingredients for odor are likely from paper additives such as coating binders, starch and other organic products which on decomposition under anaerobic conditions cause odorous compounds. The use of antioxidants and addition of chelating agents reduce the odour caused by oxidation.

Introduction

The reason for Odor from recycle pulping in Liner kraft and Board manufacturing is something different than Chemical pulping and it is routed from Anaerobic conditions of pulp storage and effluent clarifier sludge mostly due to decomposition by Sulphur reducing bacteria and slime. Some inherent ingredients in waste paper like, size press applied starch, coating binders, Glue and PVA type chemicals used for flute adhesion, print ink residues everything organic and or volatile in nature result in decomposition andemit bad smell.

The odorous compounds in paper may originate from quite different sources. In mills with closed water system or in mills using recycled pulp, microbiological activity is frequently the main source of odour. Due to environmental regulations mills are going for Zero Liquid Discharge conditionsanaerobic conditions give reduced sulphur gases like H2S.

Packaging industry based kraft paper mills need solutions for various problems including Odor control.The sole purpose of packaging industry is for safe transport of food and medicines to long distances, without losing, flavor, taste and quality. If packaging paper itself is with bad smell and Odour, the whole purpose is nullified. Odorous compounds from paper, tetra packs, get transferred to food material in normal and cold storage due to vapor permeability. There are several potential sources for Odor in paper and there is substantial risk of volatile Odor interacting with packaged food stuff or medicines resulting in consumer dissatisfaction. Our innovative solutions are to overcome such problems of Odorous environment within packaging paper and surrounding the manufacturing process.

Organics or Inorganic salts like Aluminium sulphate along with various other process ingredients (Starch etc) and waste paper ingredients like binders, adhesives, print ink residues, glues accumulate and continuously re-circulate in closed loop of paper mill system. They bound to encourage bacterial growth and end result can vary with conditions. In normal conditions, it gives slime growth resulting in paper breaks. In anaerobic conditions, it results in smell to Clarifier surroundings as well foul smell to paper due to system closure.

Odour Assesment:

In old days, people relied on their nose for any odor assessment. There have been quite a few developments for odour assessment but still there is no accurate chemical analysis or assessment method which can match the accuracy and sensitivity of a human nose

Now the trends and techniques have changed over a period of time. People want results in numerical value with more precision and accuracy for which lot of instruments have come to market.

Causes For Odour

In a Paper Mill water system, the following bacteria will grow in aerobic (with support of oxygen) conditions:

a. Acromonas species, Pseudomonas species, E.Coli, Flavobacter species. They survive in pH conditions of 3.5 - 9.5.

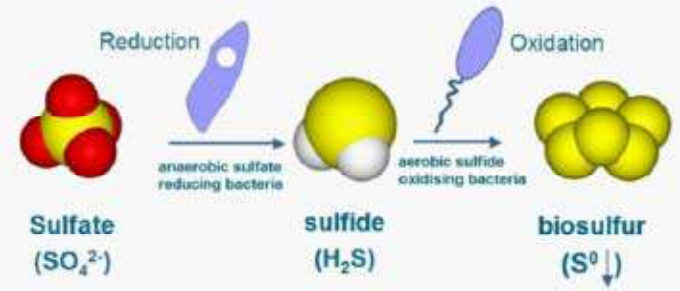
In Anaerobic (Without oxygen support) conditions the following bacteria is most predominant.

b. Sulphate reducers. pH range 3.5-10.0 (Desulfovibrio species, Clostridium species and Actinomycetes species)

The sulfate reducers cause bad smell to surroundings and even to paper. Use of chemical treatment of system for Odor control is must.

Reaction mechanism of Sulphur Reducing Bacteria (SRB) as shown here with:

Under anaerobic conditions many microorganism will produce volatile fatty acids (VFA) which are smell substances. Acetic Acid, Butyric Acid, Propionic Acid and Valeric Acid are the predominant VFAs.



Adverse Reaction resulting in bad smell

Advantage reaction for Rich Sulphur

Under anaerobic conditions many microorganism will produce volatile fatty acids (VFA) which are smell substances. Acetic Acid, Butyric Acid, Propionic Acid and Valeric Acid are the predominant VFAs.

Test Methods

H2S odor in water is detectable at as low as 0.5ppm. Concentration less than 1ppm give 'musty' or 'swampy' odor. At 1 to 2 ppm level it give 'rotten egg smell'and make water very corrosive for piping and plumbing works.

1. Lead Acetate Method: It is a sensing mechanism developed in the 1940's which is still used commonly today. Many people consider it a quick field test to ascertain presence if not quantification. Best analytical instruments are available in market as H2S analyzers.

Instructions:

- Dip the test paper into the water for a few seconds, and remove.
- At approximately 1-3ppm, the white paper will start to turn grey.
- As the concentration increases, the color of the paper will turn darker up to 400ppm.
- You can also moisten the paper with distilled water and place in an area where Hydrogen Sulfide is thought to be present (an acetate buffer is not necessary).

Handheld H2S meter (For field tests in water samples and sludge slurry)

ION SELECTIVE ELECTRODE METHOD

Measure H2S/Sulphide with this easy to use, portable, handheld meter.

The instrument is an in-situ determination of dissolved H2S/ total sulphide, pH and temperature with parallel display of the concentrations and other parameters.

H2S measurements are corrected for pH and temperature variability, leading to the most accurate sulphide measurements possible.

Innovative Solutions

The best ways to reduce odour caused by microbial activity will be to avoid Volatile Fatty Acids (VFAs) being formed. They are formed only under anaerobic conditions. To avoid VFA production, adequate oxygen concentration in the system should be ensured. Good Water Circulation, direct aeration and avoiding stagnant water can easily be implemented. The VFAs are soluble in process water and therefore without sufficient concentration, it will be very difficult to detect them.

Available technology exists for monitoring by-products of anaerobic activity. It should be noted that excess of oxygen in the water phase does not ensure oxygen surplus inside biological films and aggregates of microorganism. Biological films thus may exhibit an aerobic surface and an anaerobic interior as the oxygen is consumed while diffusing inwards. Minimization of biological film growth and biological activity in general is thus necessary to avoid local anaerobic conditions with resulting VFA production. Thus aeration is not a complete strategy as was adopted by many mills.

Now we developed few innovative solutions by combining both biocides and oxidants to address this issue of odour which was not possible either from biocide alone or by oxidation. This can be used in both machine back water and ETP systems to address odour issues. These solutions help to avoid VFAs being formed in paper process and kill anaerobic bacteria in ETP to avoid H2S gas formation.

Plant Trial Examples

Problem:

A paper mill with a complete ETP including clarifier followed by a large anaerobic sludge tank was facing an acute bad odour in their ETP. Their H2S (hydorgen sulfide) levels ran as high as 200 PPM.

Solution:

A small high pressure dosing pump, normally used for boiler water chemicals is applied to pump Maxtrol (our Odor control solution) dosing into suction line of Clarifier underflow sludge based on consistency of sludge. Based on sludge OD solids, liquid flow 500-600 gram per ton of OD sludge was pumped for two days. Further dosage was continued for another four days at 350-400 gram per ton of OD sludge into sludge transfer pump. By the end of seventh day H2S levels were below 3PPM or almost non-existent. Mill preferred to continue usage of chemical.

Conclusion

The odour is caused by mainly VFAs and H2S gas under anaerobic conditions. The closed water system or Zero Liquid Discharge conditions aggravate those anaerobic conditions thus odour issue. The risk for anaerobic conditions is increased by higher concentrations of nutrient. We can address the odour issue by using oxidants and biocides. Maxim developed innovative solutions by combining suitable biocides and oxidants to contain odour issue.

References

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