CONTROLLING OF ODOUR ISSUES IN PACKAGING INDUSTRIES

IVAX®

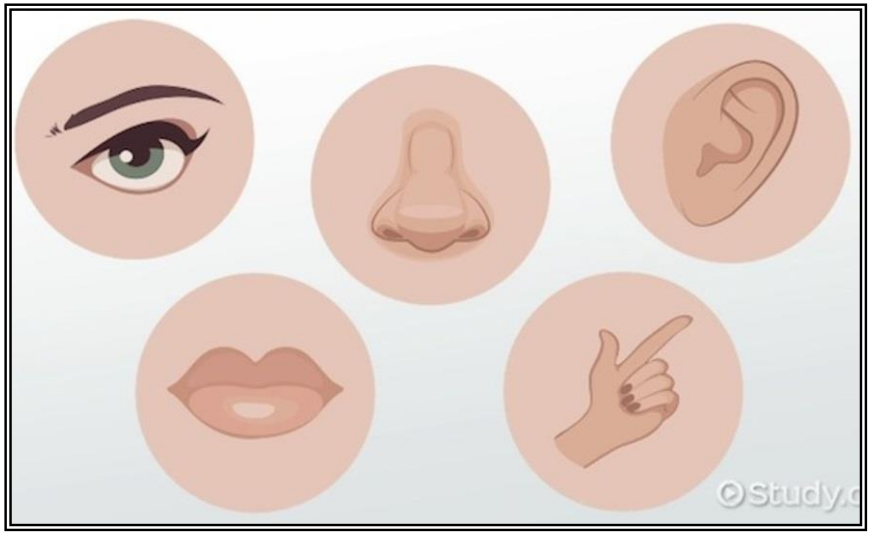
We make paper come alive!

Contents

- What is Odour?
- Odour in Paper Making System.
- Major factors and causes of the Odour.
- Common Type of Live Bacteria in Paper Industry.
- Way to control Odour.

What is Odour?

- The property of a substance that activates the sense of smell to have an unpleasant odour.
- Odour, Smell, Scent all refer to sensations perceived through the nose by nerves system.



Out of five, NOSE is our only sense organ which is having the capability to identify the odour to recognize whether it is Pleasant or bad.

Nose can only identify the GOOD or BAD Odour.

Odour in Paper Making System

- Due to increased environmental concerns paper industry is forced to use more of recirculated water which tends to compel the paper makers to keep the water circuits as close as possible. In mills with closed water system or in mills using recycled pulp, microbiological activities are mostly the main source for odour.

- Oxidation of wood extractives is the most important odour source in furnishes containing mechanical pulp or sulphite pulp.

- **“In recent past Indian paper industry has emerged as a prominent exporter of packaging paper. But, Odour is becoming a major concern for customers as well as paper makers because it develops during the period of transit”**

Factors responsible for Odour

Factors affecting paper odour		
Process	**Possible effects**	**Odor Response**
Bleaching	Alkaline stages remove extractives Chelating agents remove metal ions Oxidative chemicals initiate rancidity	**Overall Odour Reduction**
AKD Sizing	AKD sizing increases pH.	**Increased odor**
BioCide	Decreased Microbiological Activities	**Decreased Odor**
Washing	Fines & extractives are removed	**Decreased Odor**
Recycled Paper	Spores & bacteria are fed to the system	**Increased odor**
Coating Latexes	Contaminated by Volatile monomers	**Increased odor**

Causes of Odour

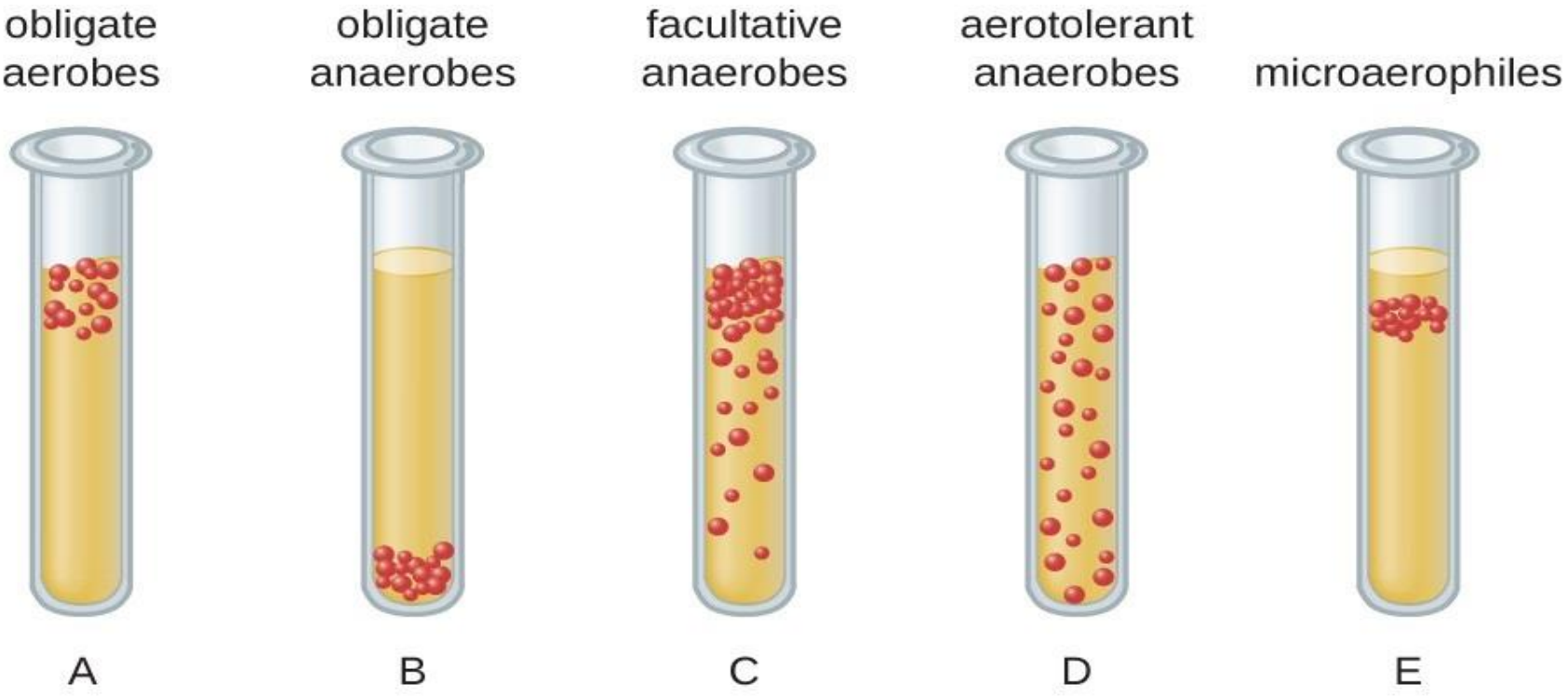
We can differentiate the causes of odour problem in two groups:

1. **Chemicals**
2. **Microbiological Growth**

- **Chemical Odour:**
  - Odour Arising from Mill Additives & Coating Binders.
  - The Oxidation of Wood Extractives.
  - Printing Inks, when interact with the paper.
  - Degraded Paper Waste coming for recycling.
- **Microbiological Growth:**
  - Anaerobic Metabolic process in the Paper Making & ETP cause the Odour Issues.
  - Due to increasing closure of water circuits & increased recovery of waste paper.
  - Sufficient supply of nutrients.
  - Sufficient dwell time.
  - Favourable pH & temperature ranges which suits the MB Activities.
  - Oxygen Free environment.

Causes of Odour

Images of different environment for Bacterial Growth:



A. **Aerobic Bacteria** gather at the top of the tube to absorb maximal amount of Oxygen.

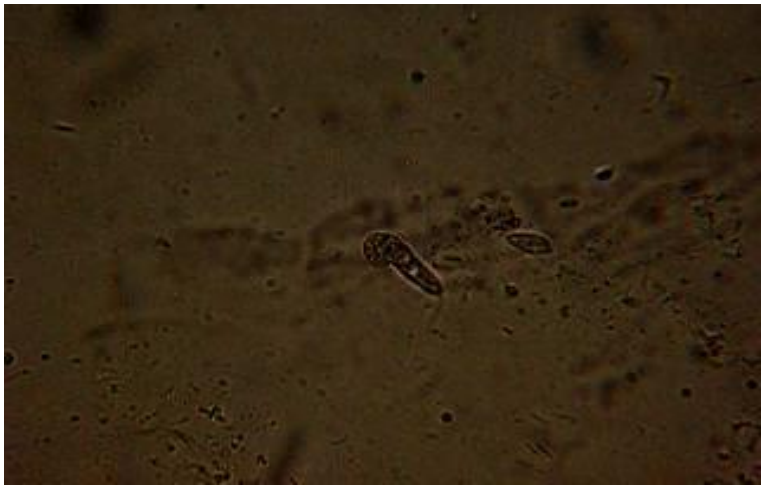
B. **Anaerobic Bacteria** gather at bottom to avoid Oxygen.

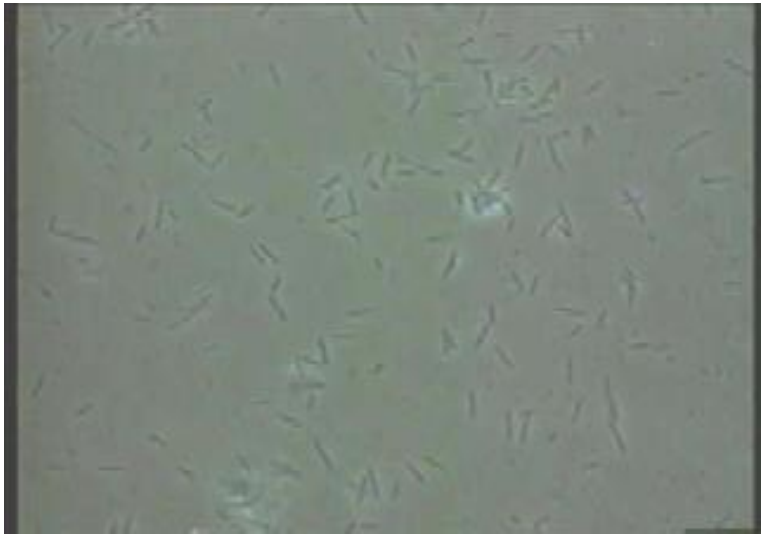
C. **Facultative Anaerobes** gather mostly at the top, since aerobic respiration is most beneficial; but as lack of Oxygen does not hurt them, they can be found all along the test tube.

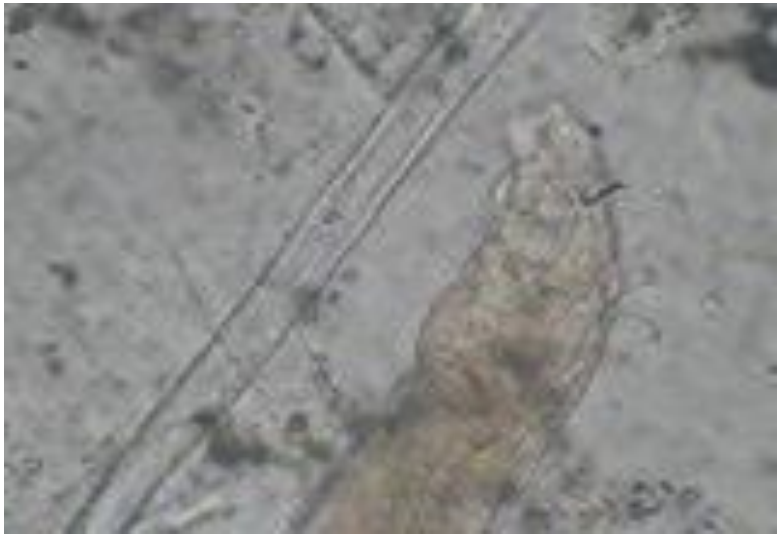
D. **Aerotolerant Anaerobes** are not affected by oxygen & they evenly spread along the test tube.

E. **Microaerophiles** gather at upper part of test tube, not at top. Need Oxygen but at low concentration.

Live Paper Process Bacteria







Investigating the Bacteria/Odour

There are various lab testing methods available to identify the bacterial growth in paper making systems:

- TBC (Total Bacteria Count) – Total Aerobic Counts
- SRB (Sulphate Reducing Bacteria) – Anaerobic Bacteria
- ORP (Oxidation Reduction Potential) – Oxidizing or Reductive
- DO (Dissolved Oxygen) – Oxygen in the system
- **VFA (Volatile Fatty Acid) – System VFA**

*** VFA is found to be most prominent factor affecting an odour issue in recycled paper packaging grades.**

What is VFA (Volatile Fatty Acids)

What is VFAs?

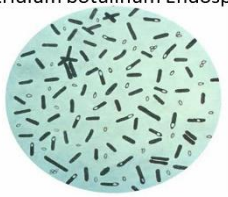
Under anaerobic conditions many microorganisms will produce volatile fatty acids (VFA), which are smelly substances. Acetic acid (vinegar odour), butyric acid (rancid butter odour), propionic acid (Swiss cheese odour) and valeric acid are the predominant VFAs.

VFAs are fatty acids with an aliphatic tail of less than six carbon atoms. The most common types of VFAs found in recycled packaging operations would be acetic, propionic and butyric.

Many different types of bacteria can produce VFAs; these include both facultative and strict anaerobic bacteria.

Facultative anaerobic bacteria can survive with or without oxygen while strict anaerobes thrive in no or low oxygen conditions.

Clostridium botulinum Endospores



Clostridium is the one of the biggest example of Bacteria present in our Packaging Industry.

Ways to control Odour / VFA

- To reduce the Bacterial Growth is one of the best way to control the Odour/ VFA.

- Ways to Control?
  - Sanitize the system (Boilout of the system)
  - Increase the level of DO in the system
  - Keep the system towards oxidative.
  - Avoid stagnant water or stock in the system.
  - Keep the system free from Microbiological Growth.
  - Keep the system recirculating always.
  - Avoid anaerobic activities in the system.

Ways to control Odour / VFA

An excellent solution to control the Odour and VFA – “DMH”

DMH (Dimethylhydantoin)

- **DMH: NaOCl technology** has proven to be especially very effective against facultative anaerobic microorganisms and sessile bacteria, providing **great reduction in VFAs which resultant in reducing odour issue** and providing excellent machine cleanliness.
- DMH stabilizer technology, by inhibiting the corrosion (Liquid & Vapour Phase) potential of NaOCl alone, can improve paper mill equipment integrity and extend machine runnability.
- As desired, planktonic efficacy can be optimized by adjusting the DMH: NaOCl ratio.

DMH (Dimethylhydantoin)

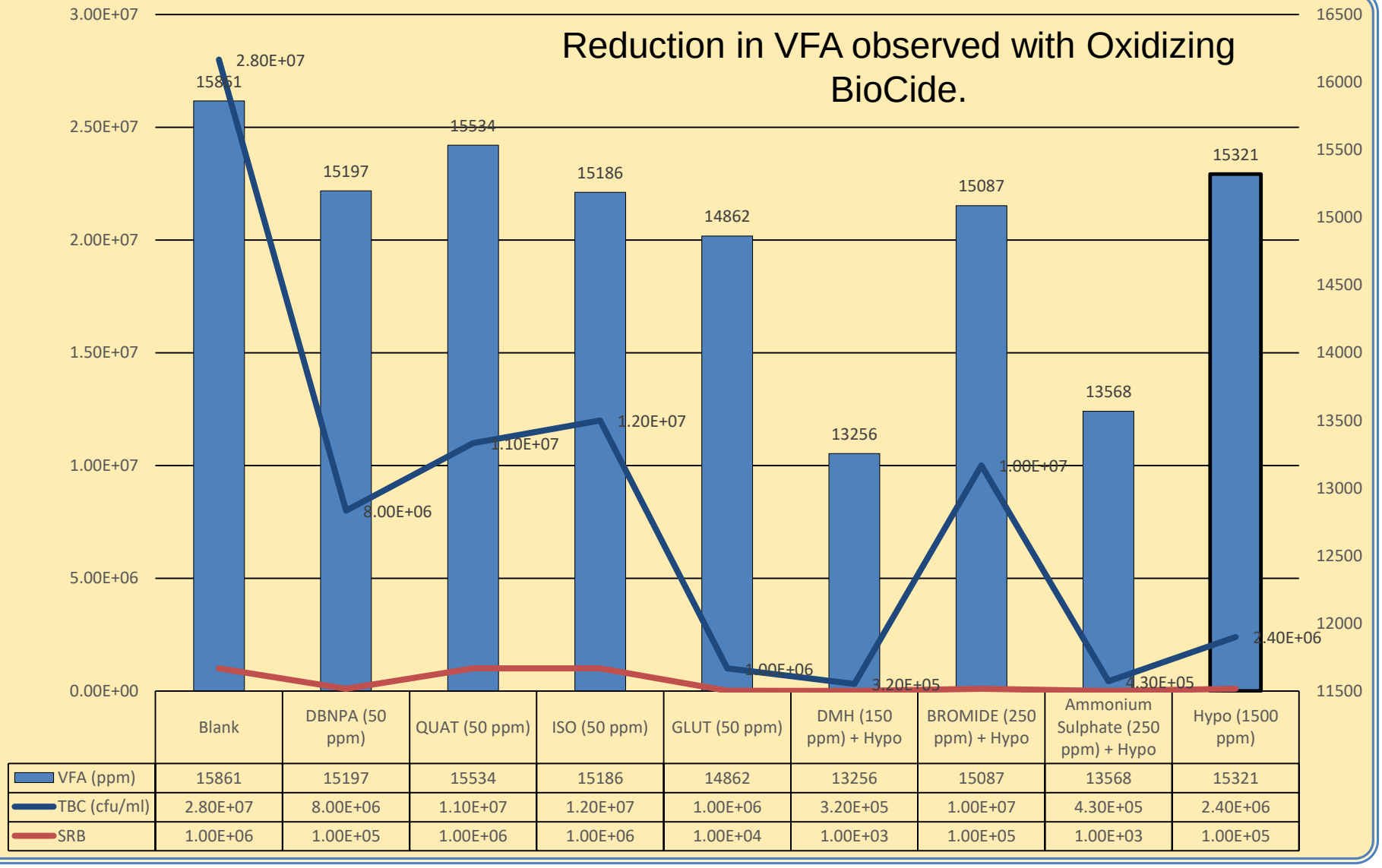
Stabilization

Ivax DMH reacts with NaOCl forming a stabilized intermediate.

Controlled Release

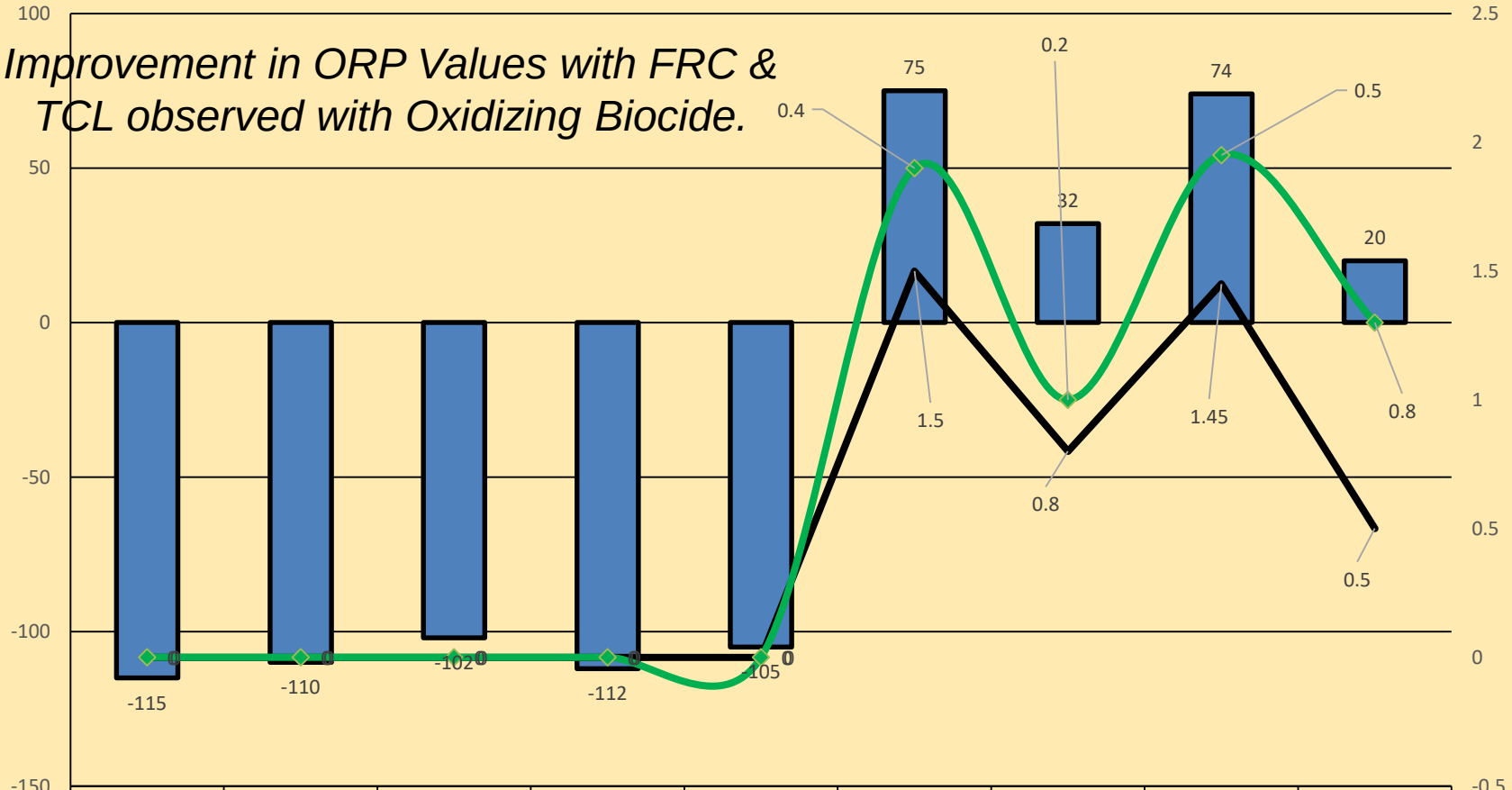
Stabilized intermediate serves as a Organo-chlorine "reservoir" releasing active chlorine "on demand" to maintain the balance between the different chemical species: "Kinetic equilibrium".

Observations....



	Blank	DBNPA (50 ppm)	QUAT (50 ppm)	ISO (50 ppm)	GLUT (50 ppm)	DMH (150 ppm) + Hypo	BROMIDE (250 ppm) + Hypo	Ammonium Sulphate (250 ppm) + Hypo	Hypo (1500 ppm)
VFA (ppm)	15861	15197	15534	15186	14862	13256	15087	13568	15321
TBC (cfu/ml)	2.80E+07	8.00E+06	1.10E+07	1.20E+07	1.00E+06	3.20E+05	1.00E+07	4.30E+05	2.40E+06
SRB	1.00E+06	1.00E+05	1.00E+06	1.00E+06	1.00E+04	1.00E+03	1.00E+05	1.00E+03	1.00E+05

Observations….



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ORP (mV)	-115	-110	-102	-112	-105	75	32	74	20
TCL (ppm)	0	0	0	0	0	0.4	0.2	0.5	0.8
FRC (ppm)	0	0	0	0	0	1.5	0.8	1.45	0.5

Observations….

Product	ORP (mV)	FRC (ppm)	TCL (ppm)	TBC (cfu/ml)	SRB	VFA (ppm)
Blank	-115	0	0	2.80E+07	1.00E+06	15861
DBNPA (50 ppm)	-110	0	0	8.00E+06	1.00E+05	15197
QUAT (50 ppm)	-102	0	0	1.10E+07	1.00E+06	15534
ISO (50 ppm)	-112	0	0	1.20E+07	1.00E+06	15186
GLUT (50 ppm)	-105	0	0	1.00E+06	1.00E+04	14862
DMH (150 ppm) + Hypo	75	1.5	0.4	3.20E+05	1.00E+03	13256
BROMIDE (250 ppm) + Hypo	32	0.8	0.2	1.00E+07	1.00E+05	15087
Ammonium Sulphate (250 ppm) + Hypo	74	1.45	0.5	4.30E+05	1.00E+03	13568
Hypo (1500 ppm)	20	0.5	0.8	2.40E+06	1.00E+05	15321

Oxidizing Biocides are more effective to improve the ORP Levels means tends to change the system from Reductive to Oxidizing.

Oxidizers are more effective on TBC, SRB & VFA.

Case History ……

Case Study 1:

A 100% recycled packaging mill was receiving complaints in Export Quality about odour coming from their Kraft Rolls. The odour included VFAs. The DMH program was started and there has been a remarkable reduction in complaints over the period of six months.

Case Study 2:

The Mill sent the Kraft Samples to abroad & all the sheets were rejected due to high odour. Mill started the program and significant reduction observed in the Paper. Hence Mill was awarded with big order.

Case Study 3:

A mill wanted to reduce the VFA levels in their final product as well in there ETP. Since the limitations in Fresh Water consumption, program was started with limited water sources & could able to stabilize the program with achieving the Mill's Target.

Case Study 4:

A Kraft mill was facing frequently odour issues & did a lot of actions to troubleshoot the issues but couldn't able to resolve. Finally the program was especially designed to cover all the inputs to treat the overall system. After struggling with N – Changes, finally could able to stabilize the program. Reduction in VFAs was not the criteria, the objective to design & develop the program was to satisfy the neighbors who were claiming the Odour Issues coming while passing through the Mill.

Conclusion…

There are N Factors involved in Odour in pulp and paper especially in Kraft & Packaging Mill. With N Factors we have N Techniques to resolve the issues, which includes mechanical & chemical solutions. We need to select the best way to resolve the Odour Issues.

DMH: NaOCl technology has proven to be especially effective against facultative anaerobic microorganisms and sessile bacteria, providing **great reduction in VFAs, which results in reducing odour issue** and provides excellent machine cleanliness.

Due to its operational flexibility and the feeding simplicity, the stabilization of NaOCl by DMH is straightforward and uncomplicated to install and operate.

Above said technology needs proper care & said dosage may vary from mill to mill.

THANK YOU