**OPTIONAL QUIZ QUESTIONS for Course 7, “Paper Machine Efficiency: Defoamers, Biocides, Detackifiers, *etc.*”**

Scroll way down to the bottom to see answers.

Session 1: Overview of paper machine deposits

1A – Which of the following categories of deposit-prone materials has its origin in the wood from which paper is made?

* Stickies
* SBR latex
* Pitch
* Alkenylsuccinic anhydride (ASA)

1B – When the amount of softwood chemical pulp fibers is increased in a furnish mainly composed of mechanical pulp fibers such as groundwood pulp, which of the following is likely to be increased?

* Only the tensile strength, but not the stretch to breakage of the paper
* Both the tensile strength and the stretch to breakage of the paper
* Only the stretch to breakage, but not the tensile strength of the paper
* Neither the tensile strength nor the stretch to breakage of the paper

1C – If titanium dioxide, a common ingredient of highly opaque paper, is subjected to incineration (in a muffle furnace), it does not lose any mass. So what is its ignition factor?

* 0
* 1
* Undefined
* Infinite

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Session 2: Wood pitch and its control

2A – Which of the following classes of wood extractives is an ester with three fatty acid groups attached?

* Pinene (pine oil)
* Abietic acid (rosin)
* Unsaponifiables
* Triglyceride fats

2B – What is the name for the value of pH at which one-half of the carboxyl groups present on wood resin materials (or other substances) will be in their dissociated (negatively charged) ionic state?

* pHD
* Solubility point
* Most-tacky condition
* pKa

2C – For a papermaking additive to be effective at overcoming the effects of tacky materials, such as wood pitch particles, it must have two capabilities. One of them is to render the surface non-tacky, for instance by presenting a water-loving layer facing the aqueous solution. What was the other necessary capability of such an additive, based on the lecture?

* Having an affinity for the surface of the tacky material, often by having a positive charge or a water-hating character
* Being well dispersed in the aqueous phase so that it can prevent association of tacky particles with each other
* Being able to fully dissolve the tacky materials, resulting in their uptake into the mesopore structures of cellulosic fibers
* Having the ability of cross-link the tacky material so that its effective molecular mass is higher and it has a low modulus of elasticity

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Session 3: Stickies and their control

3A – What are the most common sources of deposited materials that are called “stickies” by papermakers?

* Wood resins such as triglyceride fats and fatty acids
* Pressure-sensitive labels and latex from paper coatings
* Rosin-type (terpene) compounds such as abietic acid
* Alkenylsuccinic anhydride (ASA) and its hydrolysate

3B – What is generally the most favorable way to retain potentially sticky or tacky materials within a paper product during its formation?

* Allow the tacky or sticky substances to grow to medium size, so that they are less disruptive to the paper sheet when they are retained.
* Aim for maximum practical size of the tacky or sticking substances so that there is a minimization of interference with inter-fiber bonding in the paper.
* Pass the tacky or sticky material three a screen under pressure so that it has elongated form, which is easy to retain during paper formation.
* Retain the particles of tacky or sticky substances onto solid surfaces, such as fibers, while they are still small.

3C – How does a nonionic block-copolymer additive (such as a product that has hydrophobic sections and hydrophilic ethylene oxide sections) render surfaces less likely to stick to surfaces?

* Steric stabilization due to the hydrophilic chains extending outwards from the surface
* Steric stabilization due to the hydrophobic chains extending outwards from the surface
* Charge neutralization due to the absence of ionic charge on the additive
* Polymer bridging due to the very high molecular mass of the additive

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Session 4: Biocides and slime control

4A – What is a typical sequence of events leading up to the development of slime holes during the formation of paper?

* Microbial cells in suspension agglomerate with each other, eventually leading to large enough agglomerates to cause a problem when they are incorporated into a wet web of paper.
* Individual cells of bacteria or fungal microbes become entrained into flow, and eventually they become part of the paper, leading to slime holes, breaks, smells, and slipperiness.
* Microbial cells in suspension deposit on surface to form biofilms, which build up over time, followed by entrainment of multi-cellular slime particles and their incorporation into the wet web of paper.
* Microbial cells in suspension remain benign until they interact with microstickies, such as poly(vinylacetate), after which they grow exponentially and cause holes in the wet web of paper, often leading to breaks of the web.

4B – Three of the following are established methods to monitor the seriousness of slime problems, such that the test results can be used as a basis for making adjustments in a slime-control program. Which one of the following is NOT an established test method for slime monitoring?

* Mass spectrometry
* ATP (adenosine triphosphate) tests
* Plate counts of bacterial colonies (Petri dish)
* Microscopy, supplemented by tactile and odor evidence

4C – Which of the following agents falls into the classification of an oxidizing biocide?

* Organosulfur
* Cationic biocide
* Isothiazolin
* Chlorine dioxide

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Session 5: Case studies involving inorganic deposits

5A – Which of the following terms is a synonym for inorganic compounds that have come out of solution and deposited firmly onto wetted surfaces within a paper machine system?

* Scum
* Scale
* Slime
* Sediment

5B – Which of the following types of scale is often associated with a locally higher temperature within a paper machine process environment?

* Barium sulfate
* Ferrous hydroxide
* Calcium carbonate
* Aluminum oxalate

5C – What type of metal is highly susceptible to pitting corrosion, especially when part of the surface may be covered by deposits and when chloride ions are present in solution?

* Titanium
* Cast iron
* Stainless steel
* Epoxy-coated copper

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Session 6: How organic deposits form

6A – What type of surface-active material tends to form tacky deposits when subjected to repeated changes in water level, splashing, and air entrainment, *etc.*, within a papermaking system?

* Insoluble monolayers spread on fiber surfaces
* Insoluble monolayers spread at the air-water interface
* Soluble monolayers spread at the air-water interface
* Soluble multilayers spread at the air-water interface

6B – When a very dilute solution of cationic agent is sprayed onto the plastic filaments of a forming fabric (or other such surface), why don’t the negatively charged pitch particles go onto the surface due to attraction of opposite charges?

* The negatively charged pitch particles become agglomerated together by the action of the cationic agent.
* The negatively charged pitch particles become sterically stabilized so that they tend to remain as the suspended phase, regardless of the cationic nature of the treated surface.
* Chains of the cationic agent extend out into the solution phase and prevent the approach of the pitch particles, in a manifestation of steric stabilization.
* Negatively charged, water-loving polymers such as hemicellulose interact strongly with the cationic agent at the surface, rendering it unwelcoming to hydrophobic particles.

6C – Which of the following substances is known to result in highly tacky deposits in systems where alkenylsuccinic anhydride (ASA) is being used?

* Aluminum ions (Al3+)
* Magnesium ions (Mg2+)
* Cationic starch
* NaOH to raise the pH above 9

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Session 7: Foam control

7A – What problem on paper machines is associated with blemishes on the paper surface, pinholes, deposit formation, solids losses from spills from chests, reduced product strength, and reduced drainage rate?

* Foam
* Dissolved and colloidal substances
* Loss of papermaker’s alum
* Slime

7B – What is the most essential ingredient of a highly effective defoamer additive, without which it would not function?

* Hydrophobic particles
* Oil
* Insoluble surfactant
* Stabilizer

7C – Why does the acidification of calcium carbonate contribute to foam problems?

* The acidity activates the calcium stearate stabilizer on the surface of calcium carbonate particles.
* Acid treatment causes the release of hemicellulose, which slows gravimetric drainage of foam bubbles.
* The calcium carbonate is converted to calcium hydroxide with the release of carbonic acid, which stabilizes the foam.
* Carbon dioxide gas is released, in addition to calcium ions.

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Session 8: Scheduling and conducting boilouts

8A – What is an appropriate time to arrange a pause in production so that a boilout of the paper machine system can be conducted?

* During a period of high efficiency production, to be proactive
* Not until the chaos period
* After the efficiency of operation has begun to erode
* During the start-up period

8B – Which of the following substances can be solubilized, and for instance removed from a contaminated wet-press felt, by treatment with either an acidic solution or an alkaline solution?

* Lignin
* Al(OH)3 (alum floc)
* CaCO3 (calcium carbonate)
* Grease

8C – What kinds of binders, holding deposits together, can be broken down by enzymatic treatments?

* Geochemicals (e.g. silicates, aluminates)
* Latex and wet-strength resins
* Hydrogen bonds and ionic attractions
* Proteins and starch

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ANSWERS TO QUIZ QUESTIONS, COURSE 7

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