Pitch deposition in newsprint mills using certain kaolin pigments

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ABSTRACT

A sharp increase in press section pitch deposition sometimes accompanies the use of calcined kaolin pigments to enhance the opacity and brightness in some newsprint-related papers. This article reviews research reported in three previous papers that has led to the discovery of a new mechanism for pitch deposition. The cause of deposition appears to be tetrasodium pyrophosphate, a dispersant widely used for stabilizing kaolin slurries. It can liberate aluminum from the kaolin pigment into the aqueous phase of the slurry and raise the pH to values above 6. Under these conditions, sticky aluminum soaps can form through the reaction of aluminum with the soap anions of fatty and resin acids present in paper machine white water. Avoiding this type of pitch deposition problem should be possible with other dispersants.

Application:
Mixing clays at pH values below 6 and changing to dispersants other than tetrasodium pyrophosphate can eliminate pitch deposition.

IN RECENT YEARS, MANY NEWSPRINT mills have begun using clay in some of their grades. Unfortunately, this has frequently resulted in a considerable increase in pitch problems. The problems occur in the press section where sticky deposits form on the granite rolls. The deposits can cause holes in the sheet and breaks. Increased felt plugging also occurs as does deposition on the Uhle boxes.

Approximately five years ago, we learned that this problem was not specific to a single mill but was happening in at least six newsprint mills using up to 5% clay. We worked closely with one mill and tried every conventional pitch control measure available without success. Although the experience was frustrating, we did finally recognize that we were facing a new problem that seemed related the use of clay.

Without understanding what was happening, mills using clay have been coping by using more highly calcined clays that are more expensive and erosive, showering press rolls with kerosene or diesel fuel that no papermaker likes to do, and using expensive, double-bladed doctor systems. This paper reviews previous research that examined the mechanism and cause of the pitch problems and suggests solutions *(1-3)*.

DEPOSIT ANALYSIS

Our study began with a detailed chemical analysis of the deposits in the press section. **Table I** indicates typical results. Besides the average amounts of wood resin and calcium soaps, the results revealed unexpectedly high concentrations of aluminum soaps in the deposits. Measuring the concentrations of aluminum soaps in the table required development of a new procedure for their analysis *(1)*.

SOURCE OF ALUMINUM

Where was the aluminum in these deposits originating? Clay contains aluminum tightly bonded in its structure. This is usually unavailable for dissolution. We began by examining the aluminum concentration in the water phase of clay-in-water slurries. **Table II** shows the results. By examining troublesome and nontroublesome clays, we found that the problems did not correspond to a single supplier of clays nor to the degree of calcination of the clay used. Each troublesome clay did have considerable aluminum dissolved in the aqueous phase of the suspension. The nontroublesome clays had only a negligible amount of dissolved aluminum.

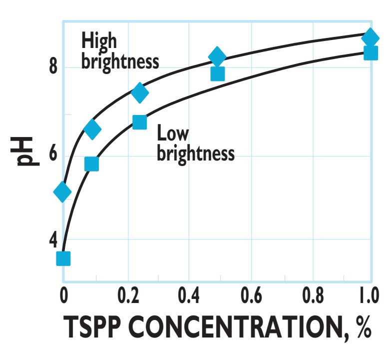
What was causing this high aluminum concentration in the troublesome clay slurries? Further examination of the composition of the clay products revealed that the only additive used is a dispersant. The most common dispersant is tetrasodium pyrophosphate (TSPP). Because phosphates and aluminum have strong affinities, we concentrated on examination of the TSPP.

The results in **Table III**—typical results have been chosen for illustrative purposes from a much larger body of data—suggest that the presence of TSPP in a kaolin clay suspension results in an appreciable concentration of dissolved aluminum in the aqueous phase of the slurry. The first line of the table shows a low aluminum concentration without TSPP. The second line is a control experiment with TSPP without clay slurry. This also gave a low concentration of aluminum dissolved in water. The purpose of this control was to eliminate the possibility that the TSPP might be introducing aluminum as an impurity. The last line in the table shows the aluminum concentration measured with TSPP and clay slurry. The aluminum concentration in the aqueous phase of the clay slurry was very high.

In further research *(3)*, we established the following for temperatures at 40°C–65°C:

Sample	Wood resin	Ca soaps	Al soaps
Mill A	29%	2.4%	25%
Mill B	26%	3.2%	32%
Mill C	25%	0.2%	27%

I. Chemical analysis of deposits



1. TSSP raises pH

- The dissolution of aluminum from kaolin slurries without TSPP for 0.5–24 h was small at < 1 mg/L in both high and low brightness kaolins with pH 5–9.
- The greatly increased aluminum dissolution from kaolin slurries in the presence of TSPP occurred at all pH values of 5–9 in high and low brightness kaolins.
- Ionic strength in a simulated paper machine white water for total dissolved salts of 0.3–1.2 g/L does not influence the greater dissolution of aluminum in kaolin slurries with TSPP.

HYPOTHESIS

The above results led us to hypothesize that TSPP in some clays can liberate aluminum from the clay. The aluminum can then react with the soap present at pH above 6 in paper machine white water because of the dissociation of fatty and resin acids according to the following equation *(4)*:

$$Al^{3+} + 3(Soap^-) \rightarrow Al(Soap)_3\downarrow$$

The result is a sticky, insoluble aluminum soap that can be an extremely effective glue in the formation of deposits.

We confirmed this hypothesis in the laboratory by synthesizing aluminum soaps at 50°C in the presence of stearate anions. This was possible only at pH above 6 and only with kaolin clay containing TSPP as dispersant.

The elevated pH required for dissolution of soap anions from fatty and resin acids results from the alkaline nature of TSPP in solution. **Figure 1** shows that TSPP in the presence of a 30% kaolin slurry can increase the pH above the threshold value of 6. At a conventional TSPP concentration of 0.2%–0.4%, the clay slurry pH can be as high as 8. Mills frequently slurry clay in paper machine white water. The TSPP provides the alkaline conditions necessary for aluminum soap formation. If the kaolin pigment is slurried in fresh water, Fig. 1 shows that the pH of the slurry will be sufficiently high to cause local pH values over 6 during subsequent mixing of the clay slurry with pulp at the proportioners.

Sample and nature	Clay product	Aluminum conc., mg/L
1 Troublesome	Fully calcined	41
2 Troublesome	Partially calcined	82
3 Nontroublesome	Partially calcined	0.8
4 Nontroublesome	Fully calcined	1.2

II. Dissolved aluminum concentrations in clay slurries

TSPP conc., % of clay	Clay conc., %	Aluminum conc., mg/L
0	30	0.02
5.0	0	1.2
1.0	30	99

III. Effect of TSPP dispersant

PROPOSED SOLUTIONS

Since we know that the aluminum soaps form only at pH values above 6, one solution consists of mixing the clays at pH values below 6. Another approach to solving the problem is to use dispersants other than TSPP to stabilize the clay products. Such alternative dispersant systems are now commercially available. **TJ**

KEYWORDS

Aluminum, clay, deposits, dispersants, kaolin, light metals, minerals, newsprint mills, paper mills, pitch control, pitch

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