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RVCM REVIEW FOR PROJECT JUSTIFICATION

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Work By:

R. C. Tebo
Process Engineer
Engineering Department

Approved By:

L. Z. Kardos
Senior Process Engineer
Engineering Department

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INTRODUCTION

This study was done to determine if seasonal trends in RVCM in the low molecular weight resins exist. From these results it can be determined what action, if any, needs to be taken to reduce the seasonal trends, variability, or the RVCM levels.

DISCUSSION

Results of the RVCM study show seasonal trends in the low molecular weight resins at the railcars, dryers, and blend tanks. However, the process is often out of control. Monthly averages, t-tests, control limits, and distribution curves all show these RVCM trends.

Seasonal trends in RVCM exist for railcar, dryer, and blend tank resin. The magnitude of the trends in 5305 is small, but the old technology 5265 resin's trends are large in magnitude. The new technology to be used in November for 5265 will improve this by lowering the RVCM by a factor of 4 or 5. The RVCM levels in 5265 will be somewhat similar, but slightly higher, than those levels seen in 5305 this year. To be able to determine what else is needed for RVCM removal, customer driven RVCM goals need to be set.

Control charts show that the system is out of control. To assist in evaluating seasonal trends adjusted values were used to compensate for the out-of-control points. The adjusted data excludes excessively high data points which were probably caused by lack of aeration air pressure or plugged blend tank spargers. The adjusted data excludes data above 10 ppm for the dryers and railcars, and above 80 ppm for the blend tanks. Including these excessively high data points would cause all seasonal trends to be masked. The plants have made numerous reports of sparger pluggage and low aeration air pressure. Pluggage of the old spargers result with loss in aeration air caused by power failures, while the new sintered metal spargers plug with $CaCO_3$ buildup.

Averages

Using adjusted averages shows a much more distinct seasonal trend. Attachment 1 shows the monthly averages and adjusted averages of RVCM. Seasonal trends are apparent for 5265 in the railcar, dryer, and blend tank. For 5305 the trends are not as easily seen, since the magnitude of the trend is smaller, especially for the 5305 blend tanks. This is further illustrated for the dryers in Table I.

TABLE I
Dryer RVCM Averages

Resin	Month	Nonadjusted Avg (PPM)	Adjusted Avg (PPM)
5265	January	4.9	4.4
	July	0.8	0.8
5305	January	0.9	0.9
	July	0.3	0.3

T-Tests

A t-test was performed to determine if the changes in the adjusted averages were statistically different from month to month. These results in Attachment 1 show that although there is usually not a significant difference between adjusted averages of consecutive months, there is a significant difference between adjusted averages of summer and winter months. The t-test, most importantly, does show that there is a significant difference between summer and winter months for all areas including the 5305 blend tanks.

Control Limits

Monthly control limits for the low molecular weight resin dryer and blend tank RVCM (based on nonadjusted data) are shown in Attachment 2. Attachment 2 shows that there is a seasonal trend for RVCM in the dryers also. Seasonal RVCM trends are even more apparent when adjusted data is used.

Upper control limits and ranges based on adjusted averages for 5305 railcar samples show a distinct difference between summer and winter performance. Control charts shown in Attachment 2 illustrate this trend in 5305. Since the 5265 resin is to go to new technology soon, no control charts were made for that resin.

Seasonal trends are more pronounced in the railcar and dryer samples than in the blend tank samples. Since there is a known RVCM gradient during pumpover, perhaps the problem is that samples taken from the blend tanks may not have been taken at the same relative time. Also, there is much more variance in the slurry analysis than in dry resin RVCM analysis, which also increases the variability of the data.

Distributions

Attachment 3 shows overlayed cumulative adjusted distributions of RVCM for each resin at the railcar, dryer and blend tank. These graphs show a definite improvement in RVCM from winter to summer. Attachment 4 gives monthly distributions of the unadjusted data. Upon close observation, some trends can be seen when reviewing this raw data. (Due to the volume of material, Attachment #4 was only provided to those on the distribution with an asterisk by their initials.)

The nonadjusted distributions indicate that the process is not in control. Eliminating major problems such as lack of aeration air and plugged spargers in the blend tanks would help greatly. Some possible ways of eliminating these problems is to install flow alarms which would tell operators when a sparger is plugged, when there is insufficient aeration air, or when the aeration air is turned off. When aeration air is low, another compressor should be put on line. Flow alarms would signal a problem with plugged blend tank spargers immediately and eliminate the problem of detection lag time. Currently it takes at least 24 hours to analyze blend tank samples before a RVCM problem can be diagnosed.

CUSTOMER NEEDS

Once the process is in control it will satisfy current and anticipated customer needs. Future RVCM targets should be set based on customer and regulatory needs as defined by the Business Area and R&D. To give a rough idea of what is currently needed, Leland Haefner in R&D notes that Klockner's 5305 specification for RVCM is now 3 ppm and may soon be lowered to 1 ppm. He believes that it would be beneficial if we could supply resin below 0.5 ppm consistently.

Hoechst wants 5305 and 5265 below 3 ppm, however, Vista has an internal specification of 1 ppm for resin going to Hoechst. When out of control points are removed from the data, the adjusted upper control limit for 5305 in winter is 0.49 ppm, which will satisfy Klockner and Hoechst. New 5265 technology is expected to reduce RVCM by a factor of 4 to 5. However, conclusions cannot be made with current data since the effect that the new technology will have on the 5265 RVCM is not defined.

POTENTIAL PROJECTS

The process appears to be adequate for anticipated customer needs once it is in control. However, some safeguards such as low flow alarms and/or adjustments in operating procedures are necessary to gain control of the process. Some potential projects which could further reduce RVCM if needed in the future are listed in Table II. The recommended projects at this time are safeguards such as low flow alarms on aeration air lines at the blend tanks and silos. The cost of the safeguards increases dramatically with automation and complexity.

SUMMARY

Seasonal trends do exist in the low molecular weight resins. Once the new technology 5265 resin is being produced, however, trends will not be as strong. It must be determined, based on customer needs, whether further RVCM removal is needed. In order to cut down on variability in RVCM, it is recommended that low flow alarms be installed on the aeration air lines to the six low molecular weight silos and to the eight small slurry blend tanks. No further action is recommended until it is shown that additional RVCM removal is needed.