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14. ABSTRACT
This report covers the second quarter technical aspects of the project. During this quarter a key foundational task was completed and several more were started. I is

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EXECUTIVE SUMMARY

During this quarter WPC completed the product trial and disseminated the pigments and solvents to all research groups to test in the next stages of this project. Three consecutive batches of the Inhibicor 1000 were produced and all of these batches passed the standard QC specifications using the following tests: ASTM D-280: Moisture Loss at 110°C, ASTM D-1210: Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage ASTM D-2448: Conductivity µs/cm, ASTM D-1208: pH, ASTM D-281: Oil Absorption by Rub Out, FTIR: Comparable to pigment standard.

All of the research groups to part in an online training program to use JMP DOE software. These weekly training sessions gave participants the knowledge on how to use and manipulate the software to design and analyze a DOE. With this software we will be able to setup and plan out the additive package and split up the work between the research groups to not duplicate efforts. After running the DOE the data will be input back into the software to evaluate the probable effects of altering the amounts of any additives allowing the research team to choose the most effective designs for final evaluation.

Accomplishments and Milestone Update

Project Status Summary:

Task	Title	Planned Completion Date	% Completion
2.3	Inhibicor 1000 Product trial	9/23/2023	100%
2.4	Inhibicor 1000 Standard Production with Routine Quality Control Test	8/31/24	100%
1.2.1	Hybricor 204 Universal Solvent DOE for Compatibility	12/14/2023	60%
2.5.1	Inhibicor 1000 Universal Solvent DOE for Compatibility	12/14/2023	60%

Status: Tasks 2.3, and 2.4 were all completed during this reporting period and tasks 1.2.1 and 2.5.1 were started and is planned to be completed during the next quarter. This will include all of the sub-steps for the solvent DOE for compatibility(1.2.1.1-1.2.1.4 and 2.5.1.1-2.5.1.4 respectively)

Task 2.3 - Inhibicor 1000 Product trial

1. **Planned Activities:** WPC Technologies shall manufacture three batches of the pigment as a production scaled operation. Each of the three batches will be processed in the same

manor following the production log sheet created in Product Scale Up. The batches will be over seen by the plant superintendent, R&D Chemist and QC Chemist. The batches will be monitored throughout scale process to confirm that pigment conforms to QC specification. Each batch must pass all QC specifications to be deemed acceptable product. Once three batches successfully meet QC specification, the process and scale of the product is complete and can be moved forward into standard production with routine quality control testing.

2. **Actual Accomplishments:** WPC Technologies has produced three full production scale batches of Inhibicor 1000 that meet all aspects of QC specifications. See figure 1.

Figure 1: Palletized 40 lbs. bags of Inhibicor 1000

3. **Plans for Next Quarter:** The Inhibicor 1000 will be used for solvent compatibility testing in tasks 1.2 onward.

Task 2.4 – Inhibicor 1000 Standard Production with Routine Quality Control Test

1. **Planned Activities:** WPC Technologies shall manufacture the required corrosion inhibiting pigment and ensure that it meets the required specifications using the following tests: ASTM D-280: Moisture Loss at 110°C, ASTM D-1210: Fineness of Dispersion of Pigment-Vehicle Systems by Hegman-Type Gage ASTM D-2448: Conductivity µs/cm, ASTM D-1208: pH, ASTM D-281: Oil Absorption by Rub Out, FTIR: Comparable to pigment standard.

2. **Actual Accomplishments:** With the three complete batches that have all passed the standard battery of QC specification testing, WPC will have enough pigment to complete all aspects of this project. It is not anticipated that WPC will need to manufacture any additional pigment, but should this become necessary there is now a standardized process for manufacture and quality control data to refer back to for historical reference.

3. **Plans for Next Quarter:** The Inhibicor 1000 will be used for solvent compatibility testing in tasks 1.2 onward.

Task 1.2.1 – Hybricor 204 Universal Solvent DOE for Compatibility

1. **Planned Activities:** WPC Technologies, in combination with UW Eau Claire and JVIC, shall perform a solvent compatibility screening on various solvents using a design of experiment (DOE) approach at various concentrations of inhibitor for each solvent. These tests will be evaluating the viability of various solvents with the Hybricor 204 pigment with respect to reactivity, density, compatibility, and solubility (1.2.1.1, 1.2.1.2, 1.2.1.3, and 1.2.1.4 respectively).

2. **Actual Accomplishments:** All of the research groups have begun testing which solvents can potentially be used for the dispersion of Hybricor 204. WPC technologies is currently in the middle of testing reactivity (1.2.1.1) and density(1.2.1.2) at various loading levels with six different solvents. JVIC has begun testing compatibility (1.2.1.3) using a Malvern Mastersizer to get the particle distribution of the initial pigment and how it may change once it has been dispersed in the various solvents. This is being confirmed by the use of a Hegman gauge and ASTM D-1210. UW Eau Clare has begun testing the solubility (1.2.1.4) of the pigment in the selected solvents. Some of the solvents have incompatibilities with the various components in Hybricor 204 as can be seen in Figure 2.

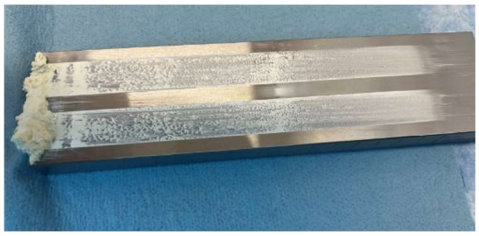

Figure 2: Solvent incompatibility leads to agglomeration of particles.

3. **Plans for Next Quarter:** Next quarter all of the sub-tasks (1.2.1.1-1.2.1.4) will be completed. Currently the research groups are planning on having an in-person meeting at WPC Technologies in Oak Creek at the end of May to discuss their results and settle on which solvents to use for Hybricor 204 moving forward. Representatives of WPC Technologies will be meeting with additive distributors and discussing the various additives needed to stabilize the dispersion (1.2.2.1) and procuring enough of these additives (1.2.2.2) to begin the subsequent tasks. Once the prime candidates for the dispersion have been selected a new DOE will be created for the additives mixture (1.2.2.3) and a D-Optimal screening design will be agreed upon. With both of these designed the tasks will be divided between the research groups and testing will continue through the end of next quarter.

Task 2.5.1 – Inhibicor 1000 Universal Solvent DOE for Compatibility

1. **Planned Activities:** WPC Technologies, in combination with UW Eau Claire and JVIC, shall perform a solvent compatibility screening on various solvents using a design of

experiment (DOE) approach at various concentrations of inhibitor for each solvent. These tests will be evaluating the viability of various solvents with the Inhibicor pigment with respect to reactivity, density, compatibility, and solubility (2.5.1.1, 2.5.1.2, 2.5.1.3, and 2.5.1.4 respectively).

2. **Actual Accomplishments:** All of the research groups have begun testing which solvents can potentially be used for the dispersion of Inhibicor 1000. WPC technologies is currently in the middle of testing reactivity (2.5.1.1) and density (2.5.1.2) at various loading levels with six different solvents. JVIC has begun testing compatibility (2.5.1.3) using a Malvern Mastersizer to get the particle distribution of the initial pigment and how it may change once it has been dispersed in the various solvents. This is being confirmed by the use of a Hegman gauge and ASTM D-1210. UW Eau Clare has begun testing the solubility (2.5.1.4) of the pigment in the selected solvents.

3. **Plans for Next Quarter:** Next quarter all of the sub-tasks (2.5.1.1-2.5.1.4) will be completed. Currently the research groups are planning on having an in-person meeting at WPC Technologies in Oak Creek at the end of May to discuss their results and settle on which solvents to use for Hybricor 204 moving forward. Representatives of WPC Technologies will be meeting with additive distributors and discussing the various additives needed to stabilize the dispersion (2.5.2.1) and procuring enough of these additives (2.5.2.2) to begin the subsequent tasks. Once the prime candidates for the dispersion have been selected a new DOE will be created for the additives mixture (2.5.2.3) and a D-Optimal screening design will be agreed upon. With both of these designed the tasks will be divided between the research groups and testing will continue through the end of next quarter.

Project Management

Issues, Risks, and Mitigation: The Inhibicor 1000 was initially planned to be manufactured during the first quarter but was actually produced during this period. This has pushed back timeline for producing the dispersion/slurry and conducting the solvent DOE for compatibility. This risks the research project not hitting future milestones according to their initially planned dates. Looking forward the project plan had built in a large amount of buffer for completing the DOE for additives and the D-optimal screening for mixture amounts for individual components. We believe that because there was enough time built in that with a concentrated effort time can be made up during these phases to get the project back onto a timeline that more closely matches the initial proposal.

Changes in approach: There have been no changes in the technical approach and we do not envision any near future changes.

Key Personnel: As was mentioned in the last report, Keetra Muana has gone on long term medical leave and has been replaced as principal investigator by Adam Nikolaus previously co-principal investigator. JVIC has also had one change in their team. Dr. Qihua Wu has left his position to take a new job. He has been replaced by Rishi J Patel.

Project Output: 8,480 lbs of Inhibicor 1000 produced.