Oryx Additive Whitepaper: src1 Performance Testing

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Authors: Dietrich, D., Cannon, B.

Background

Oryx Additive’s mission is to build trust with our customers by providing information on our latest products. With that in mind, we know that our customers want a machine and cleaning solution that removes support material quickly. With little to no advancements in the field of 3D printing cleaning solutions in the past decade, Oryx Additive became curious if there could be an improvement in chemical cleaning solutions for 3D printing consumers.

To provide enhanced solutions for our customers, Oryx Additive began extensive research to understand the fundamental chemistry and characteristics of commercial cleaning solutions. Specifically, two metrics were evaluated 1) the cleaning performance speed of removing support material and 2) the longevity of the cleaning solution bath.

Driven by data, the following testing information provides a clear picture of src1 performance results compared to the leading competitor. As a result, Oryx Additive is extremely proud of our src1 product that significantly improves the speed of support removal and extends the life of the bath capacity before needing to be refreshed.

Speed Testing Objective & Approach

Once src1 had been developed, the first testing objective was to compare the dissolution speed of Oryx’s src1 versus the leading competitor while evaluating pH between the two cleaning solutions. Testing was conducted on an Oryx Additive scal1200ht. Tempe, Arizona city water was used in the machine. The temperature of the scal1200ht was at room temperature. pH measurements were taken before and after testing and were consistent throughout the test due to the limited amount of soluble material that was dissolved.

Ten samples each of two specimen types were printed from a MakerBot Method X using red ASA model material and SR-30 support material were designed and used to simulate internal and external support material. The details of the testing specimens are shown in Figure 1.
Figure 1, Test Specimens Used

The specimens were weighed before being placed in the solution, immediately after all support material was dissolved, and finally after 1 day of drying time to accurately measure how much support material was removed.

Speed Testing Results

Figure 2 reflects the mean time of dissolving the support material for each cleaning solution and different specimen type.

![Mean Dissolve Rate (grams/hr)](image)

Figure 2, Mean Dissolve Rate
For the 5-Sided box specimen, src1 was 112% faster than the leading competitor at removing the SR-30 support material. For the Plates and Beam specimen, src1 was 101% faster than the leading competitor.

Saturation Testing Objective & Approach

The next stage tested the effectiveness or longevity over time. Specifically, we analyzed the timing to refresh.

Using the Plates and Beam specimens made from Nylon 11 with SR-30 support to act as a witness sample in the bath, one bottle of the leading competitor and one packet of src1 were compared over time. The test procedure process occurred as follows:

1. Insert Specimen.
2. Initially inspect at the 30-minute mark.
3. Check every 15 minutes until a vast majority of support material is dissolved.
4. Check every 5 minutes until the support material is completely dissolved.
5. Let specimen dry overnight and weigh.
6. Record data.
7. Add .25lb of SR-30 bulk support filament and let dissolve for 1hr.
8. Repeat steps 1-8, recording dissolution rate

During the experiment, pH and dissolved solid density were measured as metrics to assess the chemical effectiveness of the bath over time. pH value drops slightly as more support material is dissolved in the bath. A more accurate measurement of cleaning saturation than pH, dissolved solid density increases as the support material becomes dissolved and suspended in the caustic bath water. By measuring both dissolved solid density and pH over time relative to dissolution rate of support material, one can gain a clear picture of the degradation of the bath’s chemical cleaning performance before it becomes saturated.

Saturation Testing Results

Figure 3 shows the saturation testing of src1.
From the dissolution rate data, it can be concluded that when using src1, 1.5lbs of SR-30 can be dissolved before the solution begins to gradually lose its effectiveness. After 2lbs of SR-30 being dissolved, the bath should be refreshed.

Next, the leading competitor was subjected to the exact same testing as the src1 in Figure 3. The results are shown in Figure 4.

After 1.25lbs of SR-30 support material was added to the bath, it was observed that excessive foaming resulted and further testing could not be conducted. See Figure 5.
To ensure that a defective bottle of the leading competitor was not used, a second experiment was repeated with a different bottle of the leading competitor and a fresh bath with the same result as Figure 5.

Based on the two experiments, enough data points were gathered where it may be concluded that the leading competitor begins to lose its cleaning effectiveness after .75lbs. Therefore, when comparing Figure 3 and Figure 4, it can be concluded that a customer may use src1 longer (1.5lbs vs .75lbs capacity) than the leading competitor material before needing to refresh the bath. This allows the user to process 2X’s the amount of SR-30 support material before changing out the saturated bath. In short, one application of src1 can last twice as long as the leading competitor.

Conclusion

Based on shown testing data, src1 roughly cleans SR-30 material at twice the speed of the leading competitor. In addition, src1 can process double the mass of SR-30 compared to the leading competitor before becoming ineffective at removing SR-30.

Future Work

Further work is being conducted to verify and refine the findings contain herein.
Correspondence

All correspondence and questions related to this study and/or product may be directed to Oryx Additive, LLC customer support (833)-817-3533, or contact us through our customer support page on www.oryxadditive.com.