

DCOI - UP50
REDACTED
January 7, 2021

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This report is part of an ongoing analysis of the wood preservative DCOI. The overall objective is to determine the optimal treatment parameters for this preservative to ultimately be used in a full wood treatment facility. Similar to other forms of wood preservatives, DCOI is available in both liquid and solid (“block”) forms. REDACTED

The only solid DCOI, or “block” tested to date is called UP50. It is composed of 50% DCOI, 25% paraffin waxes and hydrocarbon waxes, and 25% microcrystalline wax. To analyse DCOI – UP50, four treatment cycles were completed in a pilot plant, treating the wood species Douglas Fir. The treatment cycle used during these treatments may be observed in Table 1.

Table 1. Pilot plant treatment cycle of DCOI - UP50

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*BUV = Boil Under Vacuum

After the treatment cycle in Table 1 was followed, each of the Douglas Fir poles were analysed for DCOI retention and solution uptake. A summary of this analysis may be observed in Table 2 and Table 3.

Table 2. UP50 solution uptake in Douglas Fir.

Treatment #	Wood Dimensions			Weight (kg)			Solution Uptake		
	Dia (m)	Length (m)	Vol (m ³)	Pre weight (kg)	Post weight (kg)	Uptake (kg)	kg/m ³	pcf	gal/ft ³
1	0.356	3.048	0.303	170	179.2	9.2	30.3	1.89	0.23
2	0.368	3.035	0.323	170	199.2	29.2	90.3	5.64	0.68
3	0.368	3.023	0.322	150	170	20.0	62.1	3.88	0.47
4	0.381	3.023	0.344	180	230	50.0	145.2	9.06	1.09

Table 3. Summary of UP50 treatment results

Treatment #	Solution Strength (%DCOI)	Outer Zone (pcf)	Inner Zone (pcf)	Solution Uptake (kg)	Solution Uptake (L)
1	2.38	0.482	0.291	9.2	11.06
2	2.37	0.313	0.162	29.2	35.22
3	2.40	0.283	0.110	20.0	24.13
4	2.42	0.381	0.248	50.0	60.34

Based on the information provided in Table 3, the solution strength of each DCOI -UP50 was 2.38%, 2.37%, 2.40% and 2.42% for treatments 1- 4 respectively, therefore all treatments were above the required minimum 2.3% DCOI. Additionally, each of the treatment cycles reached the required retention for both inner and outer zones, which were 0.1 pcf and 0.2 pcf respectively. Based on this information, DCOI -UP50 would be capable of treating the poles to meet required retentions.

Unlike the REDACTED, DCOI-UP50 did not have any separation or gel form throughout the analysis. To confirm this observation, samples were collected initially, and then after 5, 10, 20, and 30 hours during the boil under vacuum (BUV) cycle, as well as a final sample at the end of the pressure cycle. The liquid in each of these samples was examined under a microscope before filtration.

REDACTED However, when filtration of DCOI – UP50 was attempted, the wax clogged both filters and filtering was unable to be completed. Therefore, images of the filter paper and filtered solution are unavailable. In addition to the unfiltered liquid, a cookie was also cut from the poles after treatment and examined via cross-section and radial views. The following images represent observations made from the unfiltered solution using 20x and 40x magnification.

1. Microscope images of unfiltered solution

Based on the photo series below, it is evident that gel was not present in these DCOI-UP50 samples. Additionally, it was evident that there are few changes in the appearance of the solution over the course of each of the four trials.

DCOI-UP50 Treatment 1

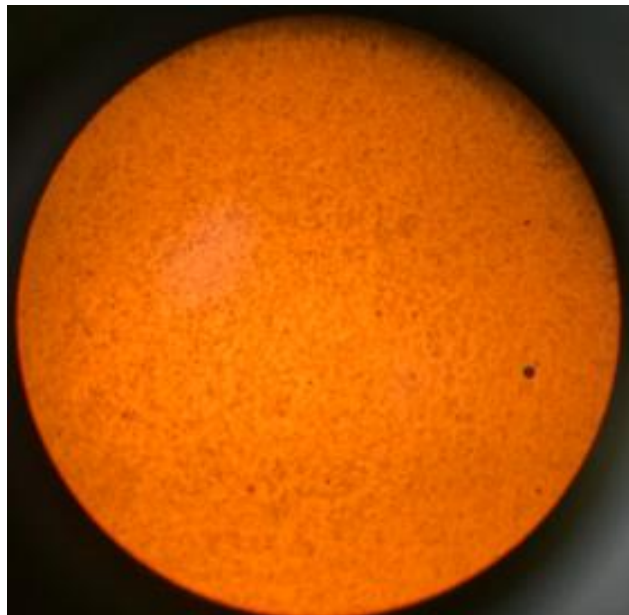


Figure 1-1: Microscope image of DCOI – UP50 Treatment 1. Unfiltered treating solution collected before treatment began. “Initial”, at 20x magnification



Figure 1-2 Microscope image of DCOI – UP50 Treatment 1. Unfiltered treating solution collected before treatment began. Initial at 20x magnification

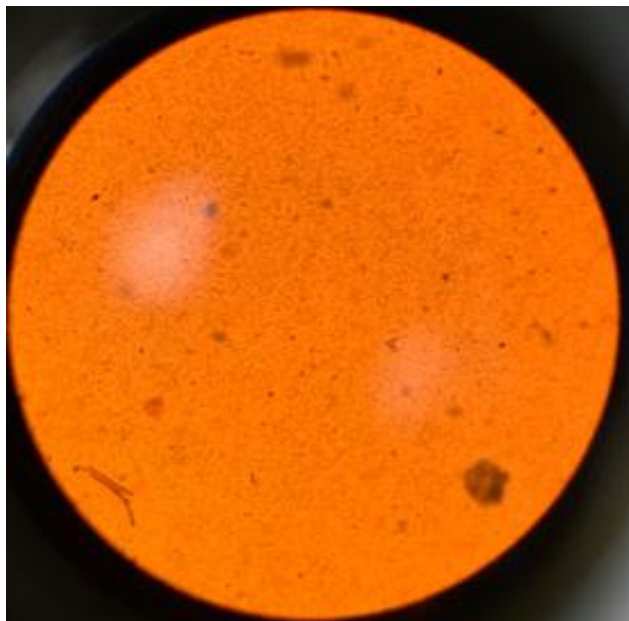


Figure 1-3: Microscope image of DCOI – UP50 Treatment 1. Unfiltered treating solution collected before treatment began. Initial at 40x magnification.



Figure 1-4: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 5 hours of BUUV. 5 hours at 20x magnification

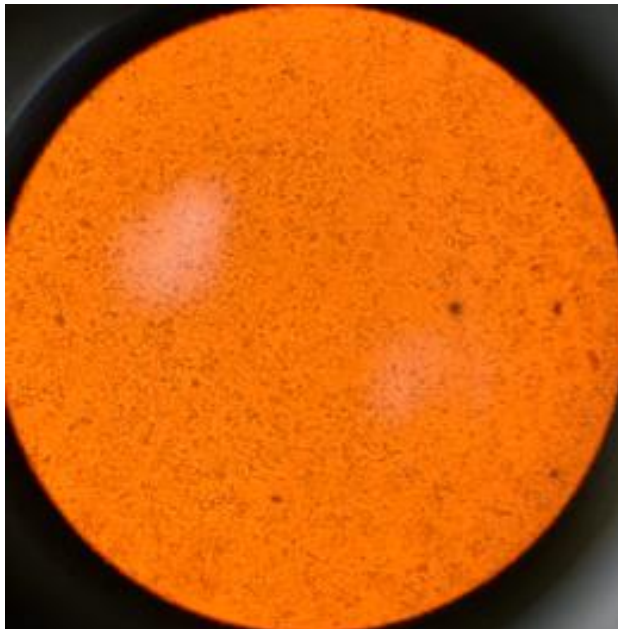


Figure 1-5: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 5 hours of BUUV. 5 hours at 40x magnification

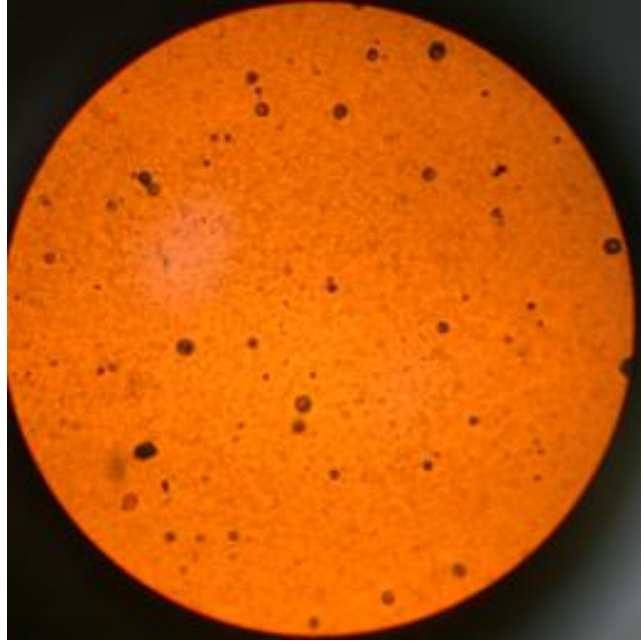


Figure 1-6: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 10 hours of UV. 10 hours at 20x magnification

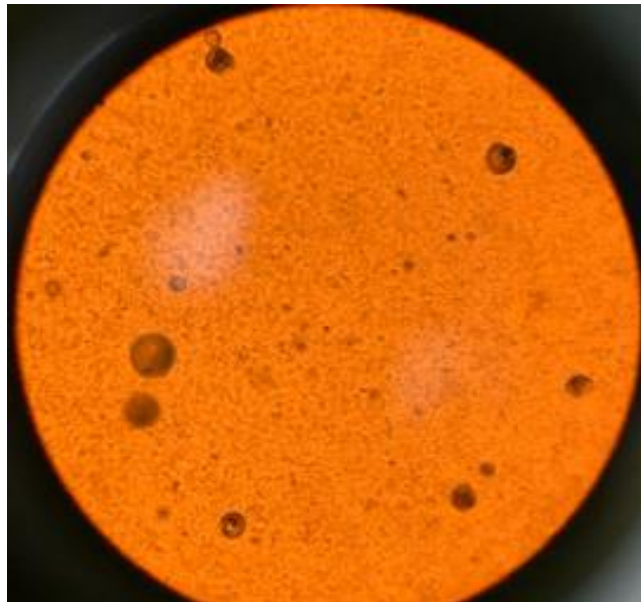


Figure 1-7: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 10 hours of UV. 10 Hours at 40x magnification

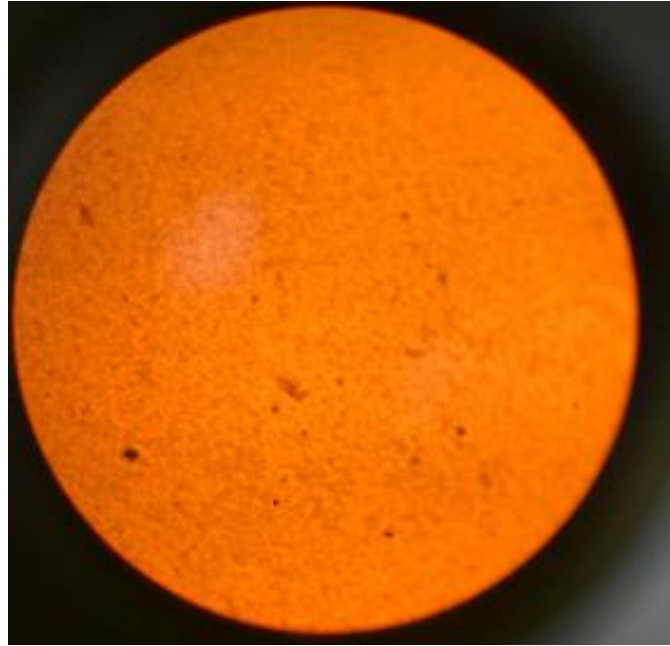


Figure 1-8: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 20 hours of UV. 20 hours at 20x magnification

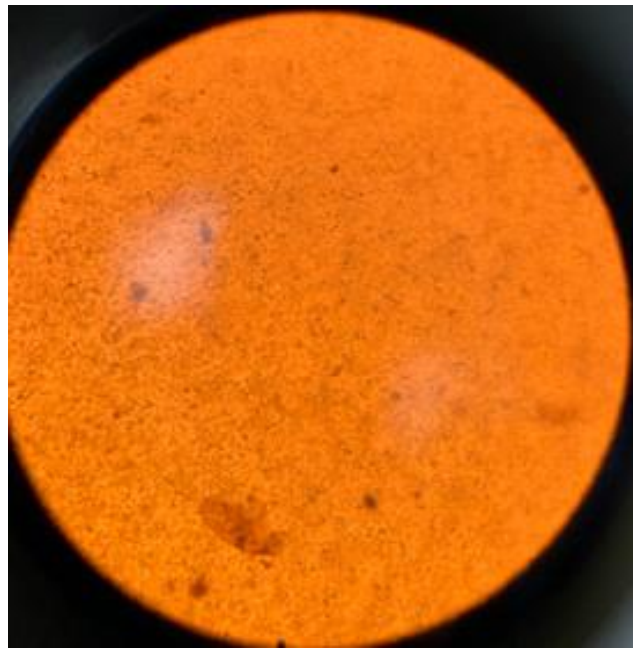


Figure 1-9: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 20 hours of UV. 20 hours at 40x magnification

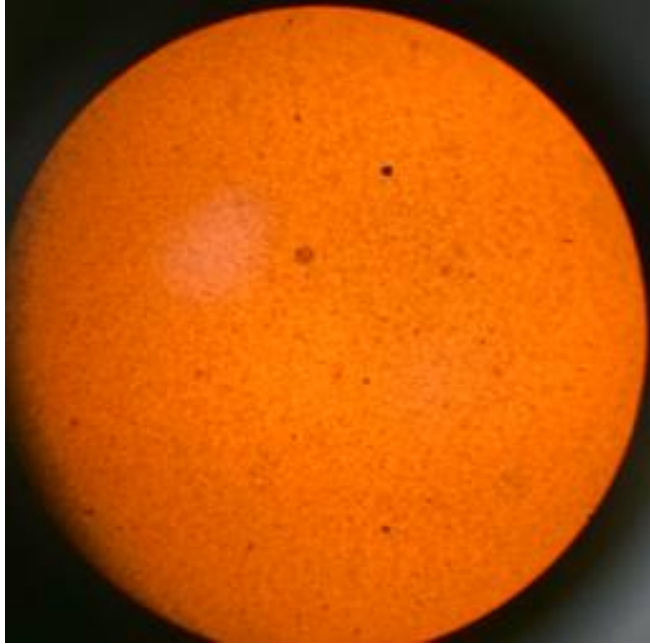


Figure 1-10: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 30 hours of BUV. 30 hours at 20x magnification

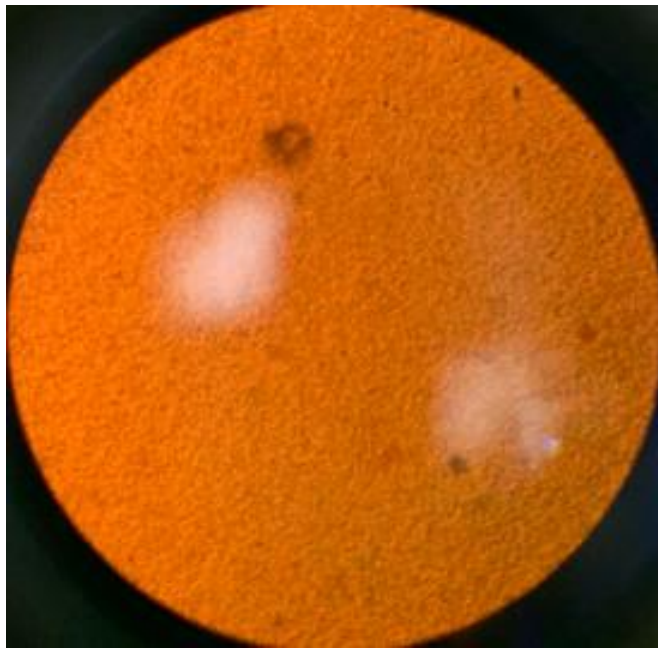


Figure 1-11: Microscope image of DCOI – UP50 Treatment 1. Unfiltered, treating solution collected directly from pilot plant after 30 hours of BUV. 30 hours at 40x magnification

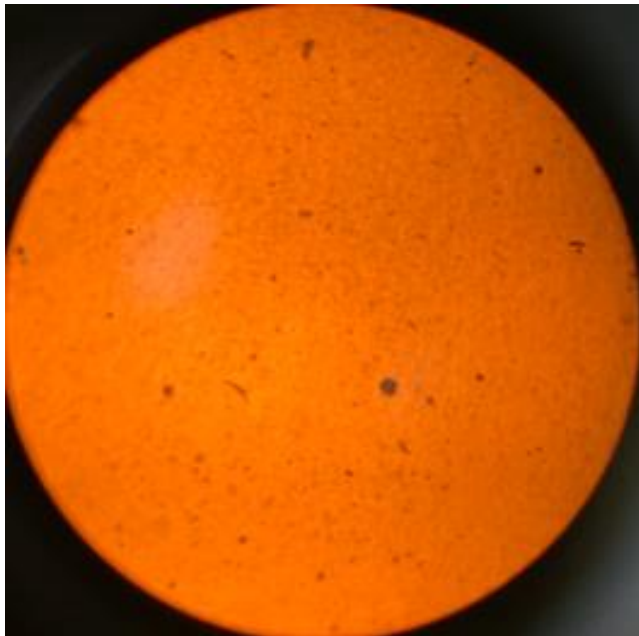


Figure 1-12: Microscope image of DCOI – UP50 Treatment 1. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 20x magnification



Figure 1-13: Microscope image of DCOI – UP50 Treatment 1. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 40x magnification

DCOI-UP50 Treatment 2

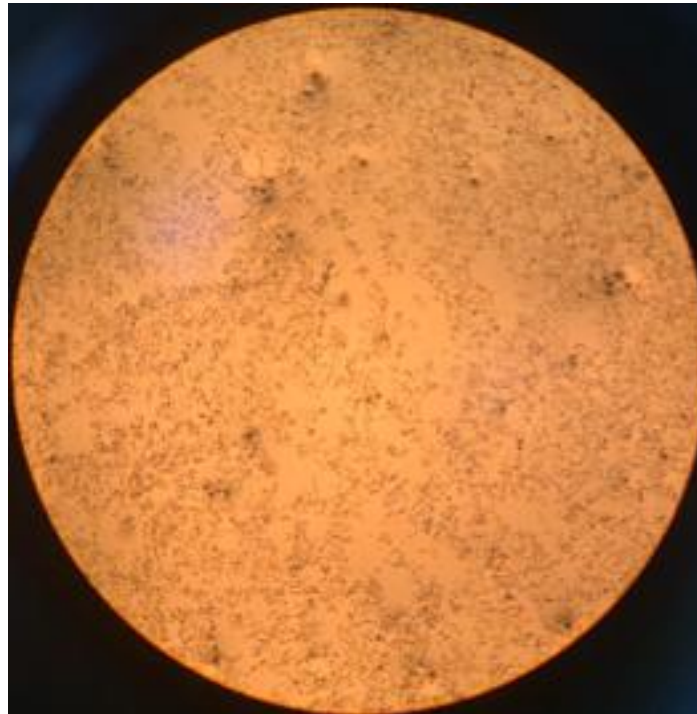


Figure 2-1: Microscope image of DCOI – UP50 Treatment 2. Unfiltered treating solution collected before treatment began. Initial at 20x magnification

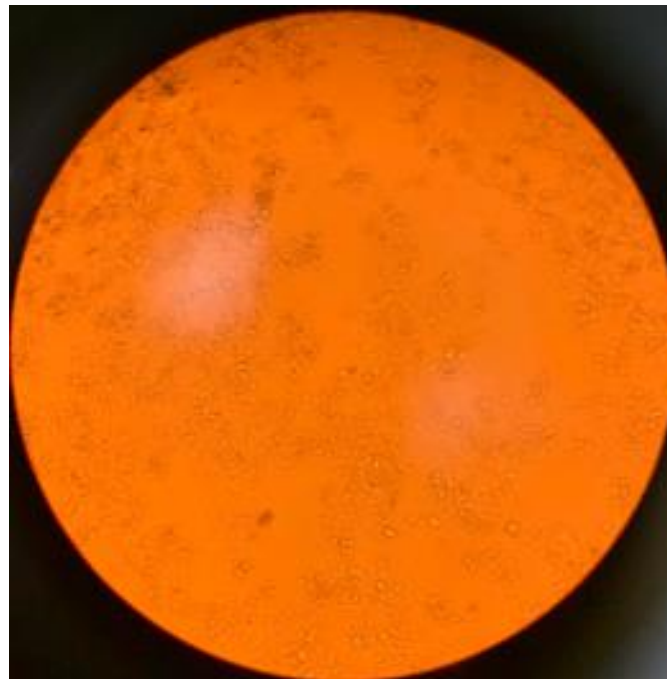


Figure 2-2: Microscope image of DCOI – UP50 Treatment 2. Unfiltered treating solution collected before treatment began. Initial at 40x magnification.

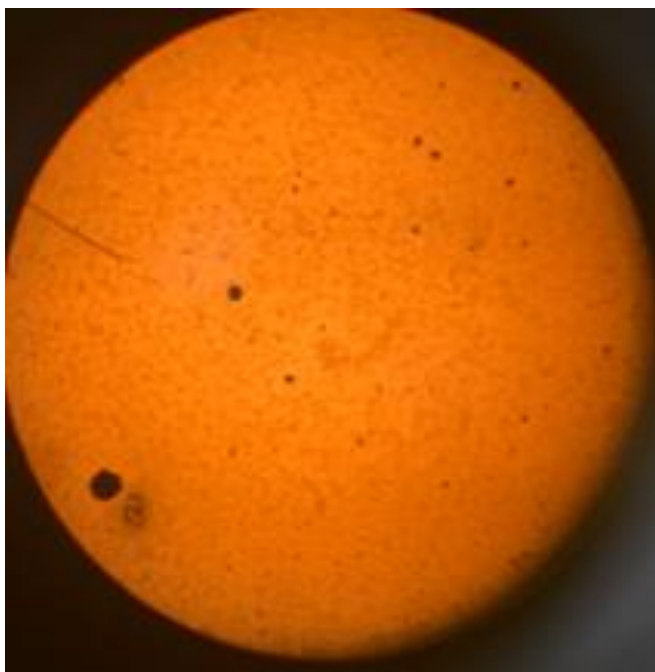


Figure 2-3: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 5 Hours of BUV. 5 hours at 20x magnification

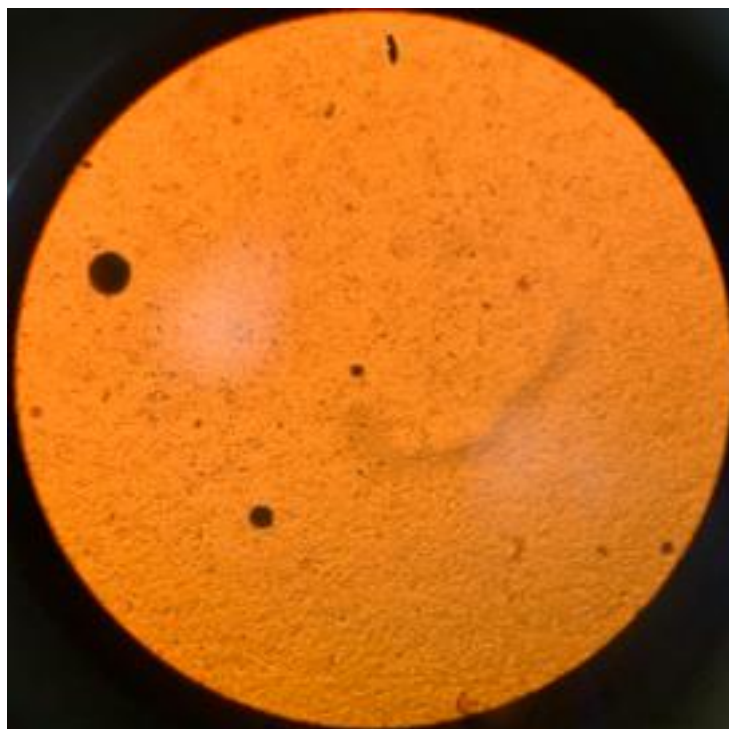


Figure 2-4: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 5 hours of BUV. 5 hours at 40x magnification

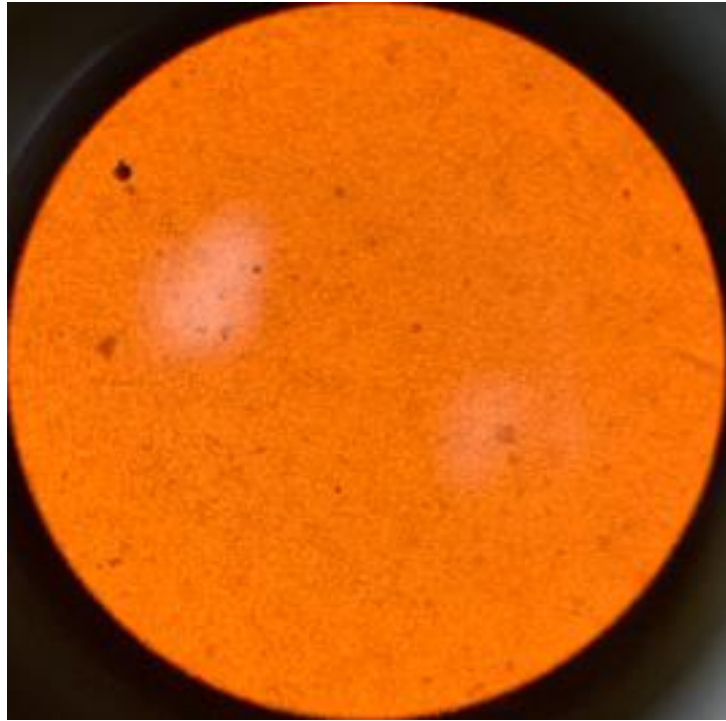


Figure 2-5: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 10 hours of BUUV. 10 hours at 20x magnification

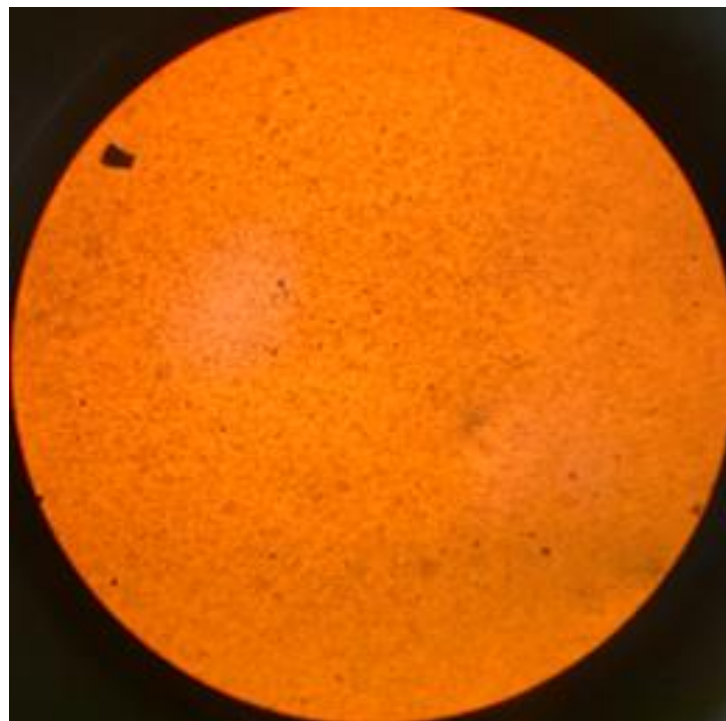


Figure 2-6: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 10 hours of BUUV. 10 hours at 40x magnification

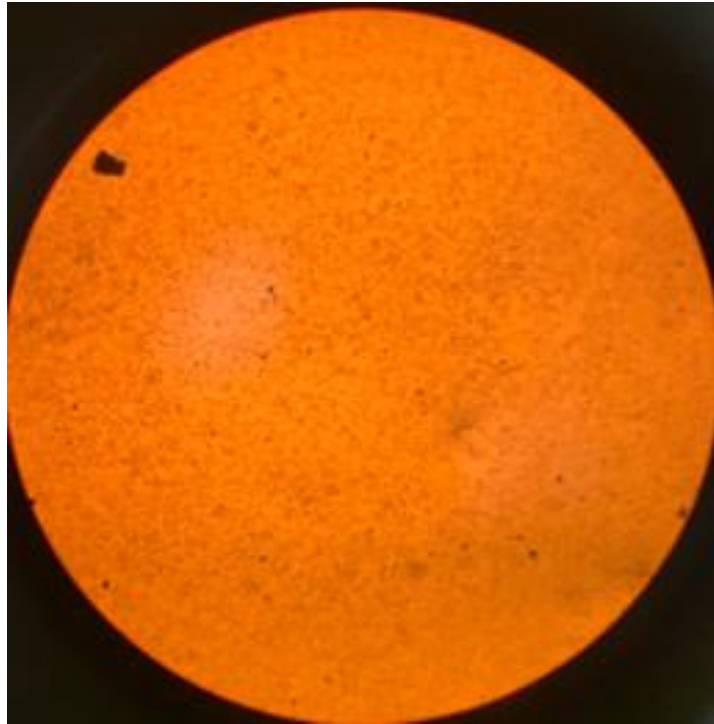


Figure 2-7: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 20 hours of UV. 20 hours at 20x magnification

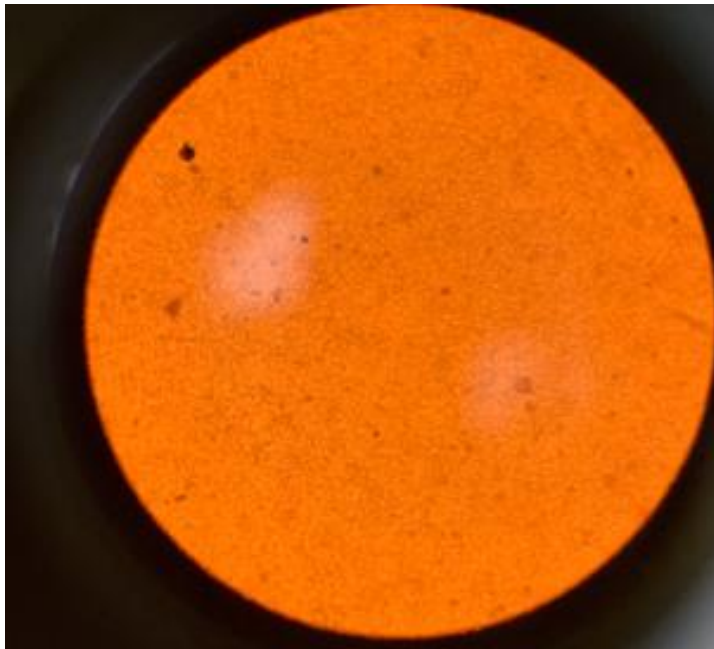


Figure 2-8: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 20 hours of UV. 20 hours at 40x magnification

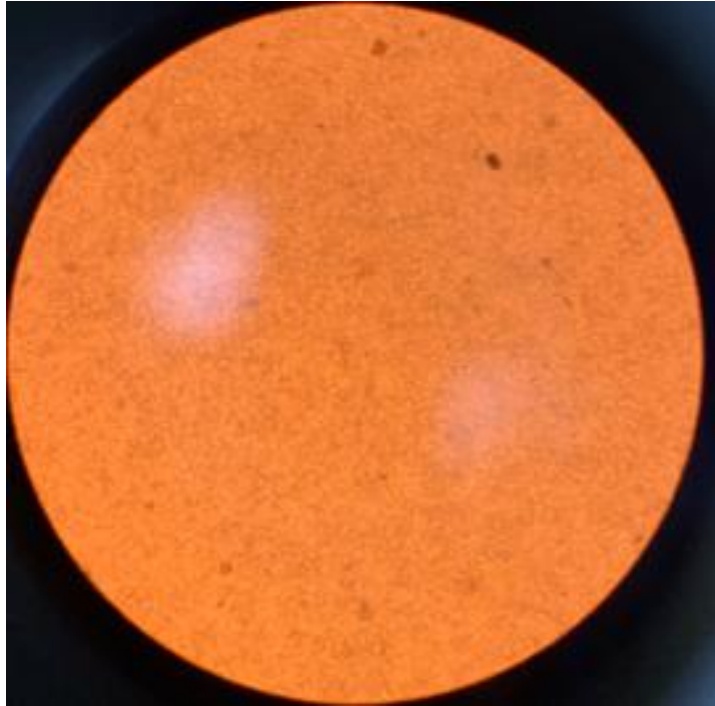


Figure 2-9: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 30 hours of BUUV. 30 hours at 20x magnification

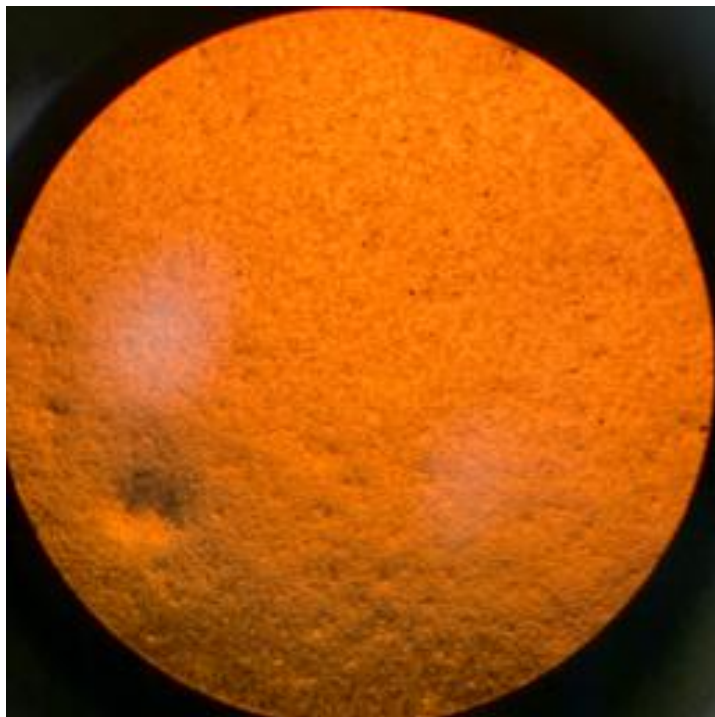


Figure 2-10: Microscope image of DCOI – UP50 Treatment 2. Unfiltered, treating solution collected directly from pilot plant after 30 hours of BUUV. 30 hours at 40x magnification

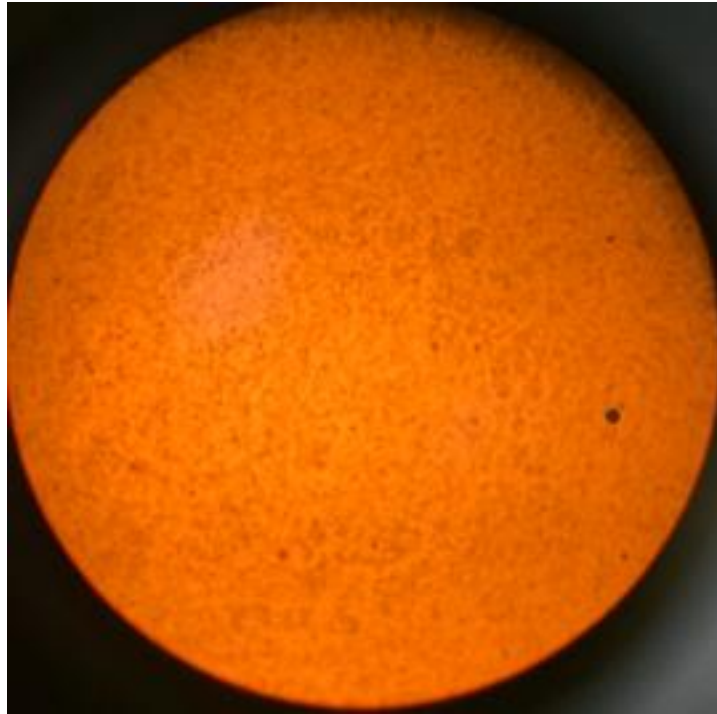


Figure 2-11: Microscope image of DCOI – UP50 Treatment 2. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 20x magnification

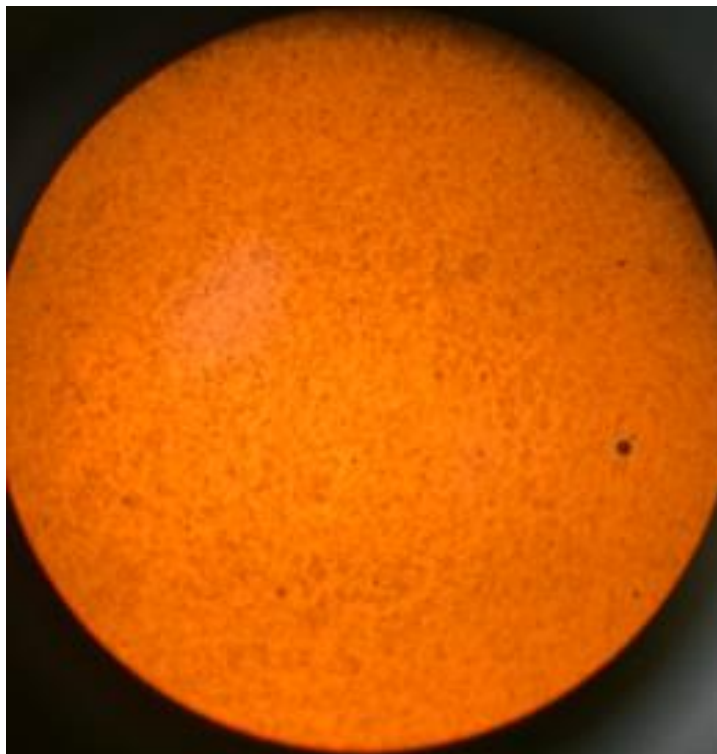


Figure 2-12: Microscope image of DCOI – UP50 Treatment 2. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 40x magnification

DCOI-UP50 Treatment 3

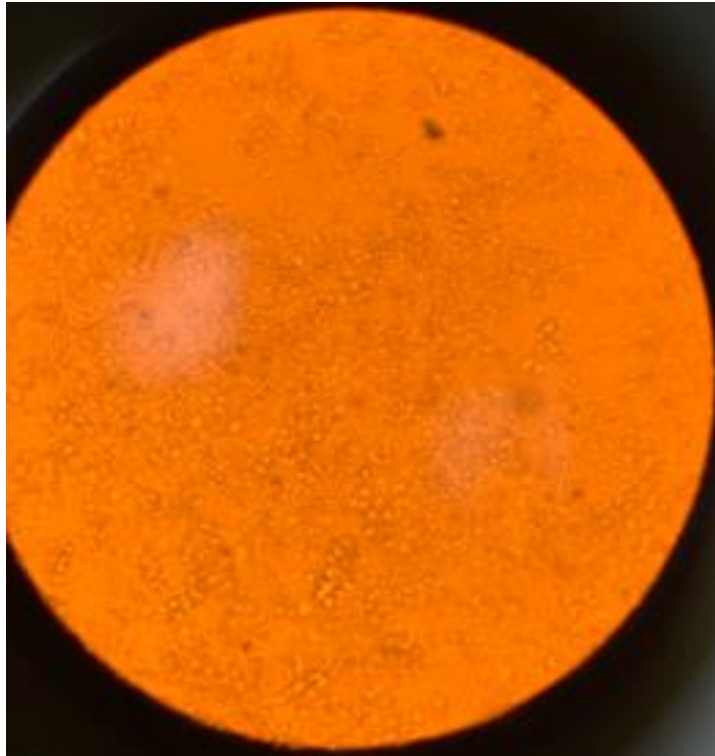


Figure 3-1: Microscope image DCOI – UP50 Treatment 3. Unfiltered treating solution collected before treatment began. Initial at 20x magnification

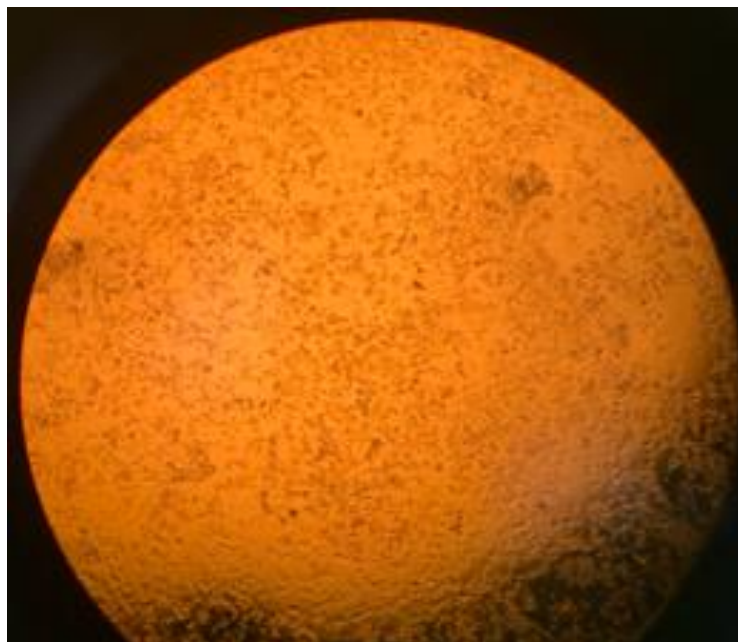


Figure 3-2: Microscope image of DCOI – UP50 Treatment 3. Unfiltered treating solution collected before treatment began. Initial at 40x magnification

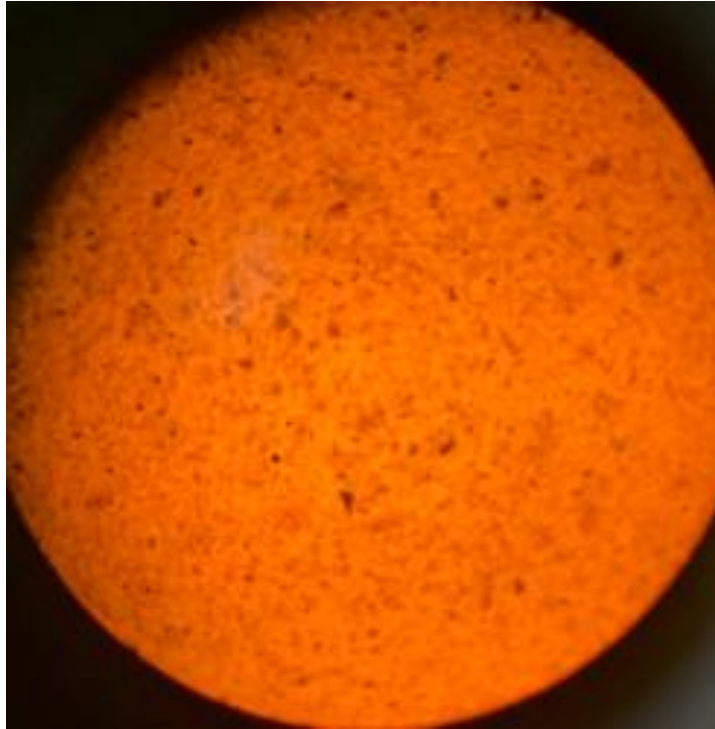


Figure 3-3: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 5 Hours of BUUV. 5 hours at 20x magnification

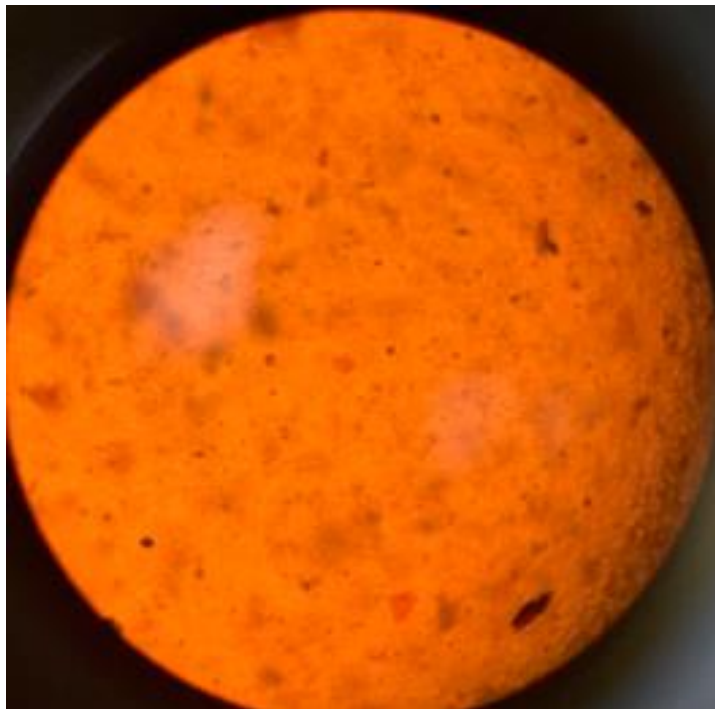


Figure 3-4: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 5 hours of BUUV. 5 hours at 40x magnification

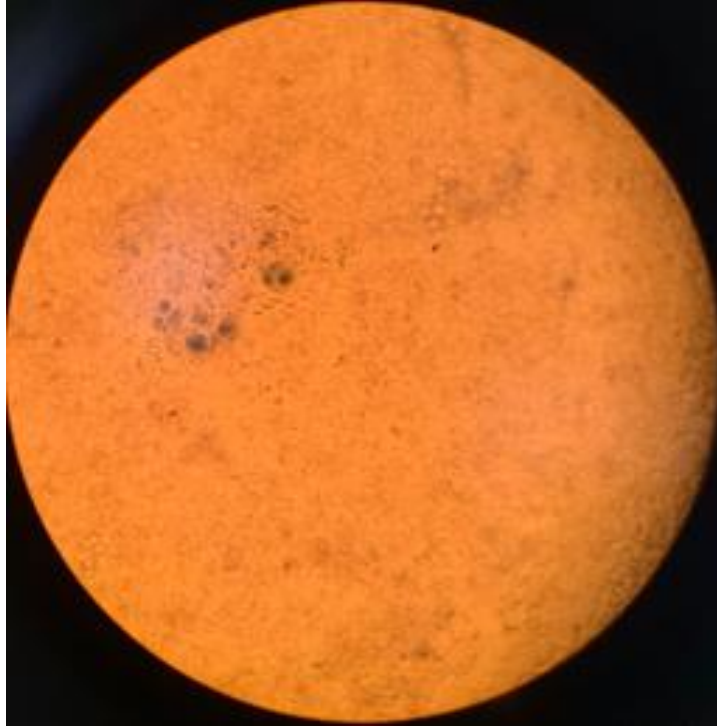


Figure 3-5: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 10 hours of BUV. 10 hours at 20x magnification

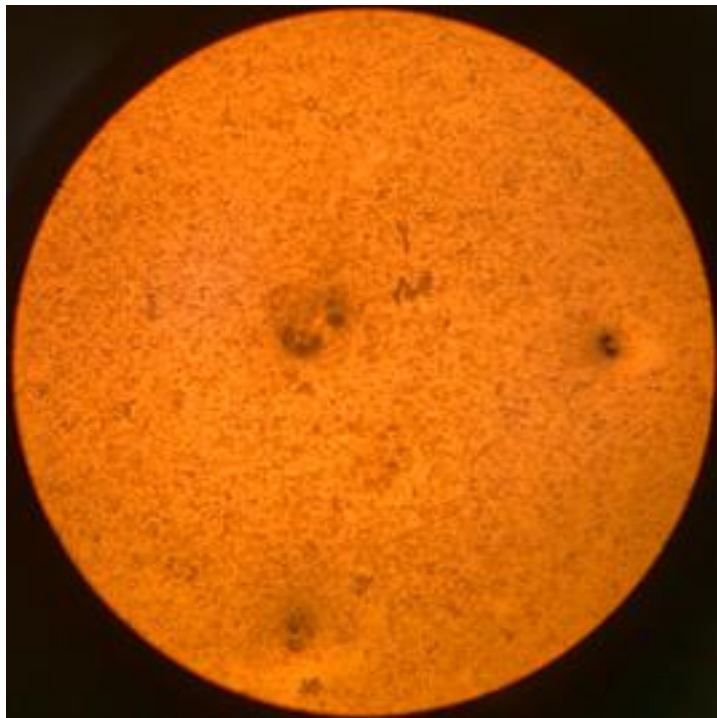


Figure 3-6: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 10 hours of BUV. 10 hours at 40x magnification

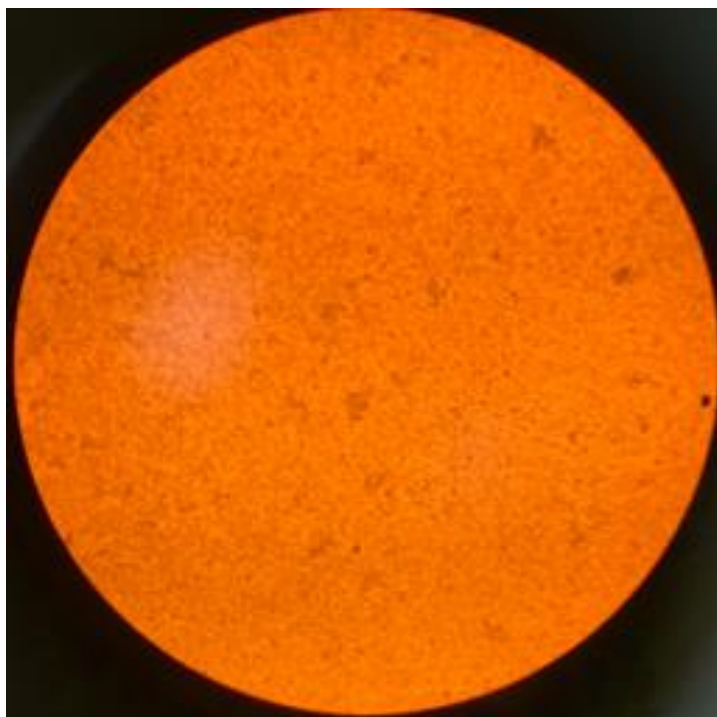


Figure 3-7: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 20 hours of BUV. 20 hours at 20x magnification

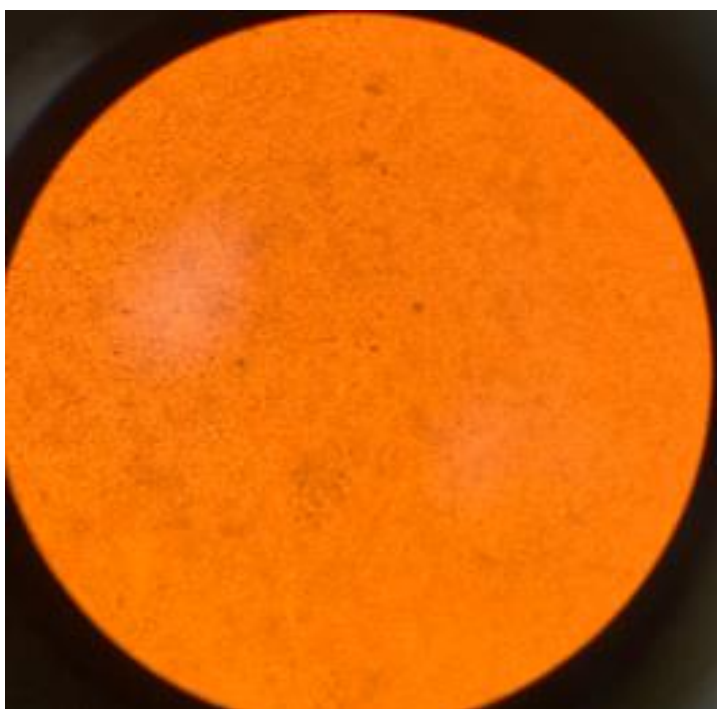


Figure 3-8: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 20 hours of BUV. 20 hours at 40x magnification

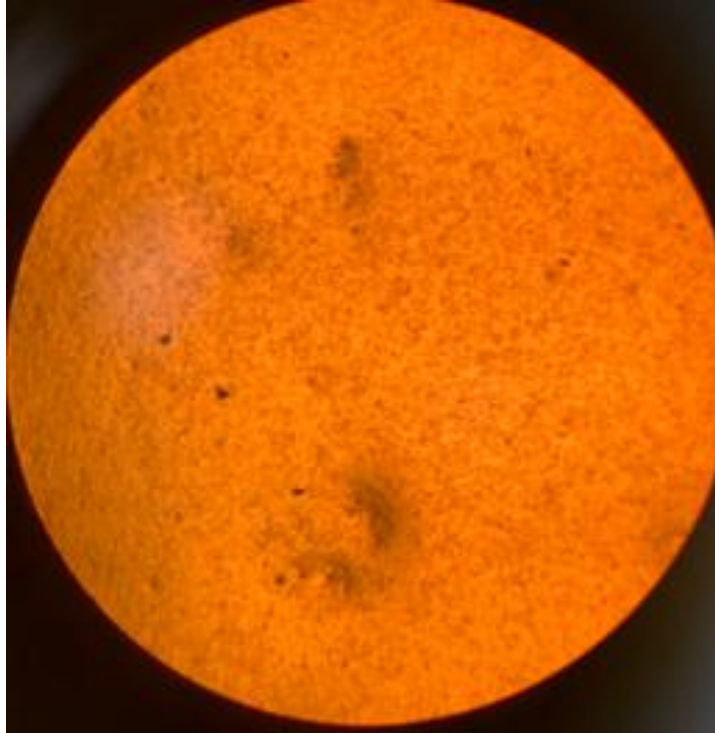


Figure 3-9: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 30 hours of UV. 30 hours at 20x magnification

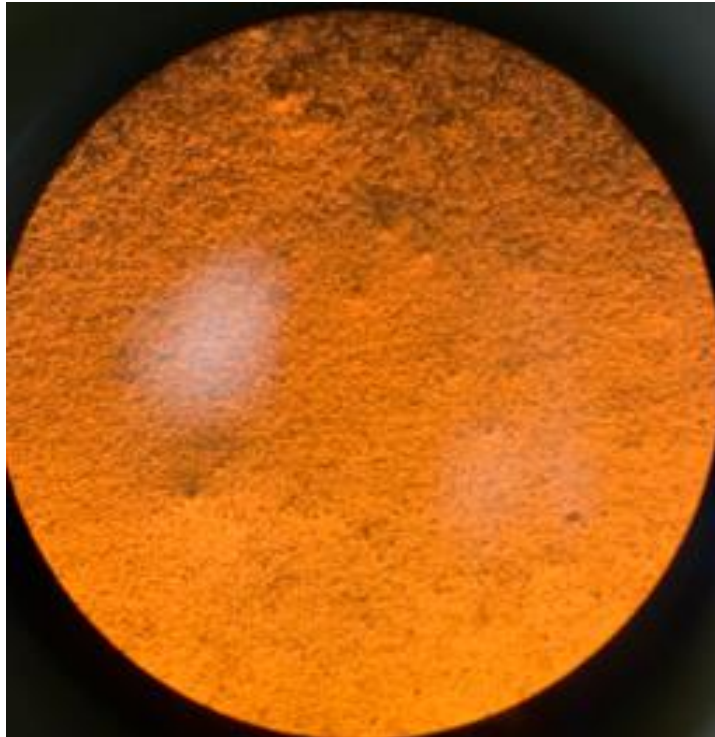


Figure 3-10: Microscope image of DCOI – UP50 Treatment 3. Unfiltered, treating solution collected directly from pilot plant after 30 hours of UV. 30 hours at 40x magnification

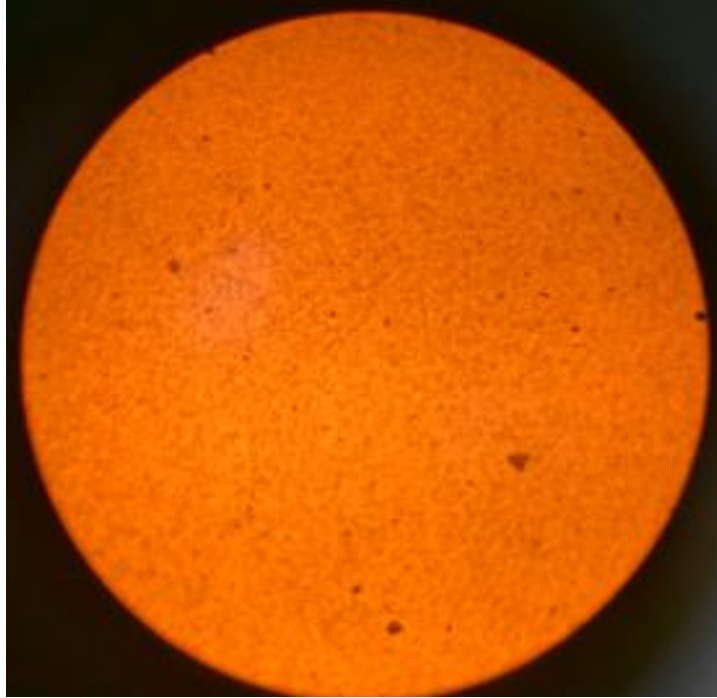


Figure 3-11: Microscope image of DCOI – UP50 Treatment 3. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 20x magnification

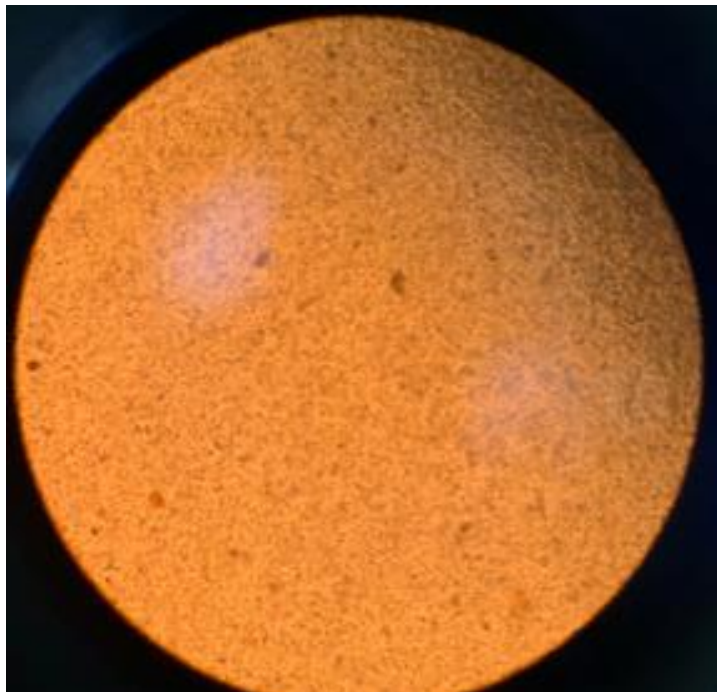


Figure 3-12: Microscope image of DCOI – UP50 Treatment 3. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 40x magnification

DCOI-UP50 Treatment 4

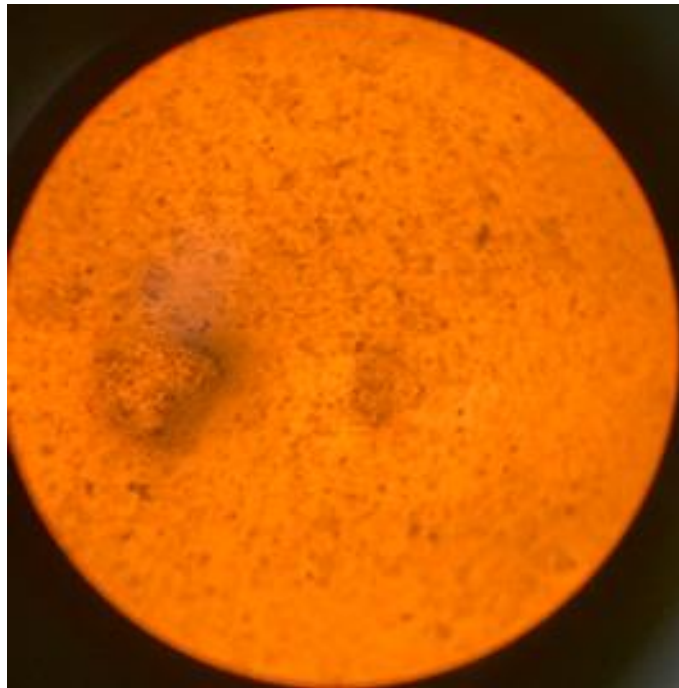


Figure 4-1: Microscope image of DCOI – UP50 Treatment 4. Unfiltered treating solution collected before treatment began. Initial at 20x magnification

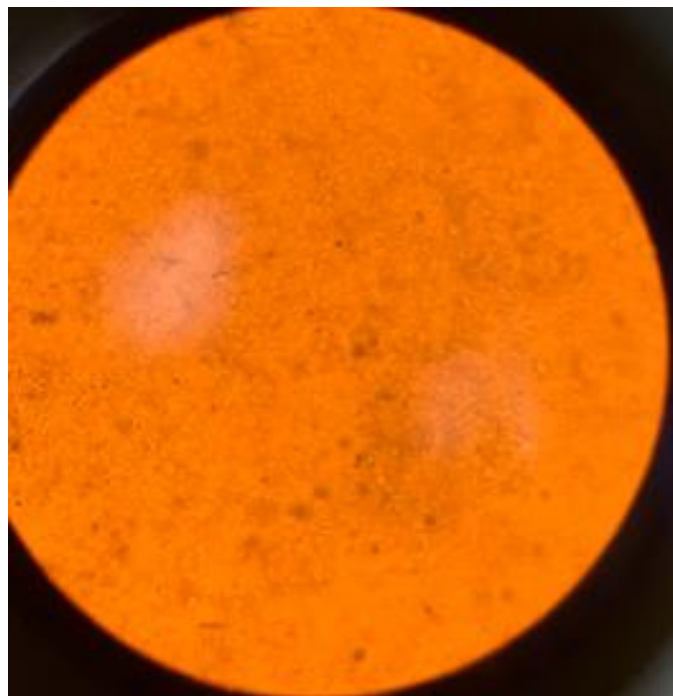


Figure 4-2: Microscope image of DCOI – UP50 Treatment 4. Unfiltered treating solution collected before treatment began. Initial at 40x magnification

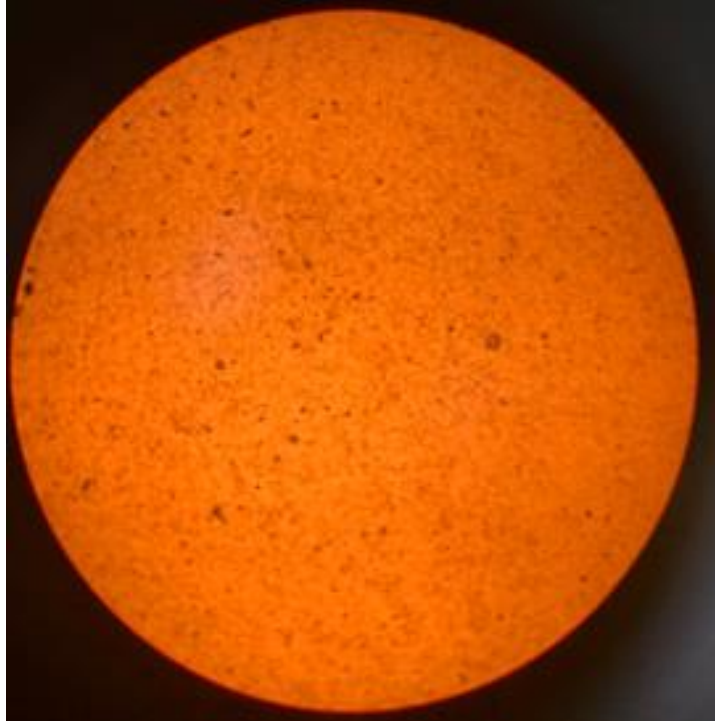


Figure 4-3: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 5 Hours of BUV. 5 hours at 20x magnification

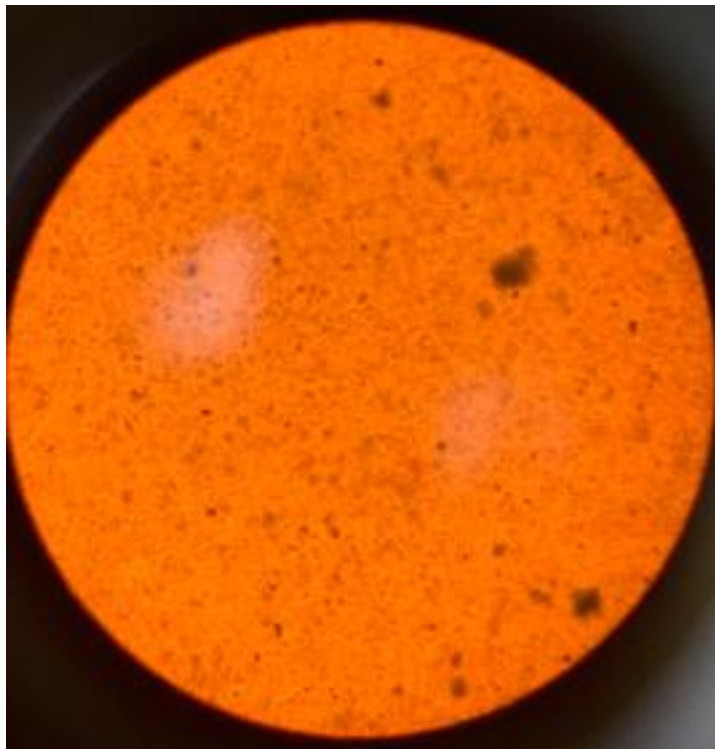


Figure 4-4: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 5 hours of BUV. 5 hours at 40x magnification

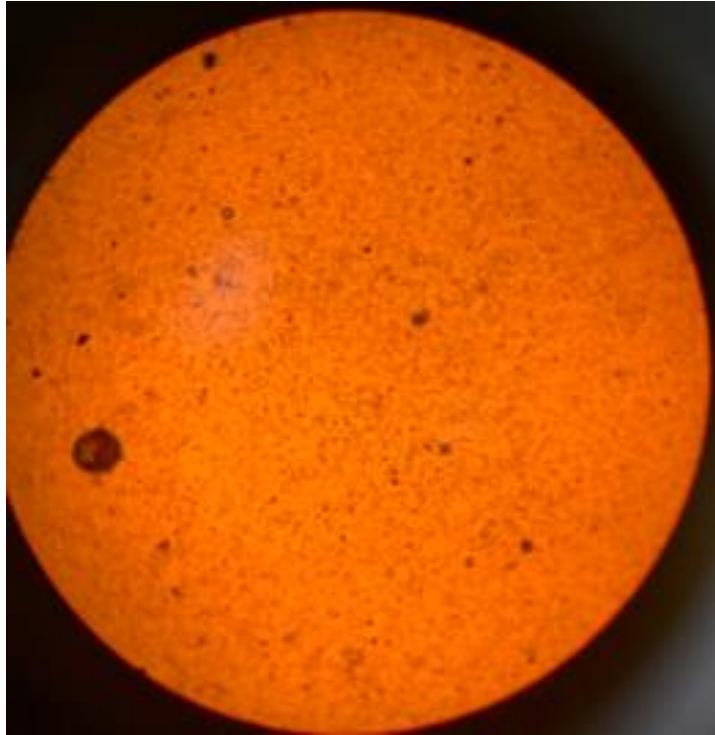


Figure 4-5: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 10 hours of BUUV. 10 hours at 20x magnification

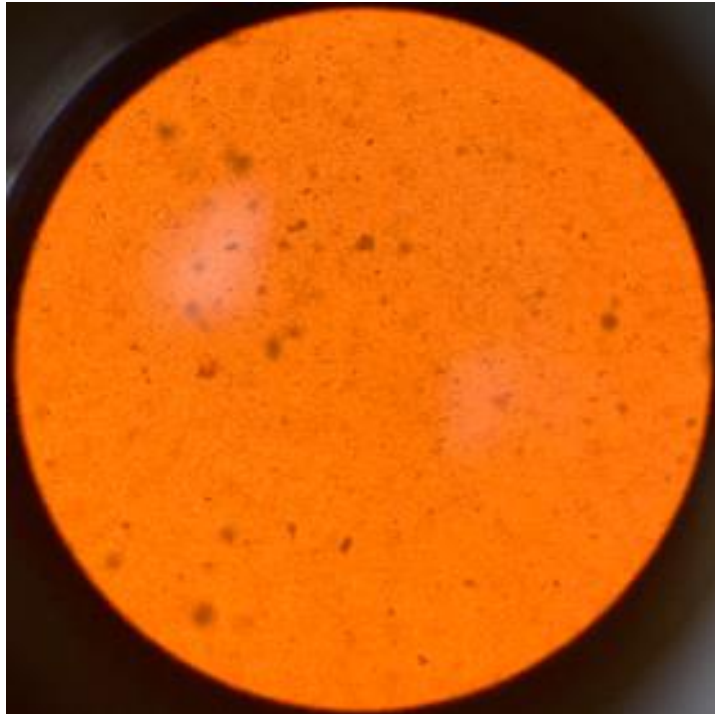


Figure 4-6: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 10 hours of BUUV. 10 hours at 40x magnification

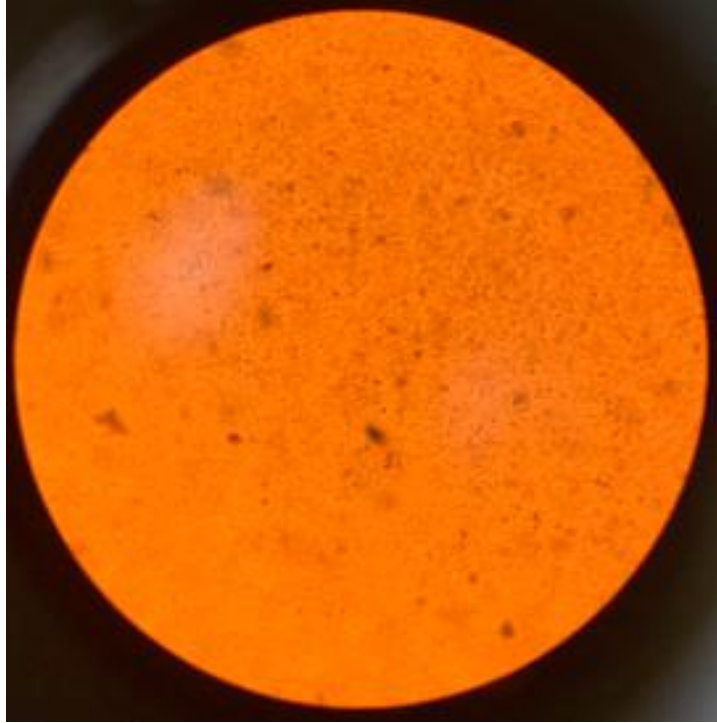


Figure 4-7: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 20 hours of BUV. 20 hours at 20x magnification

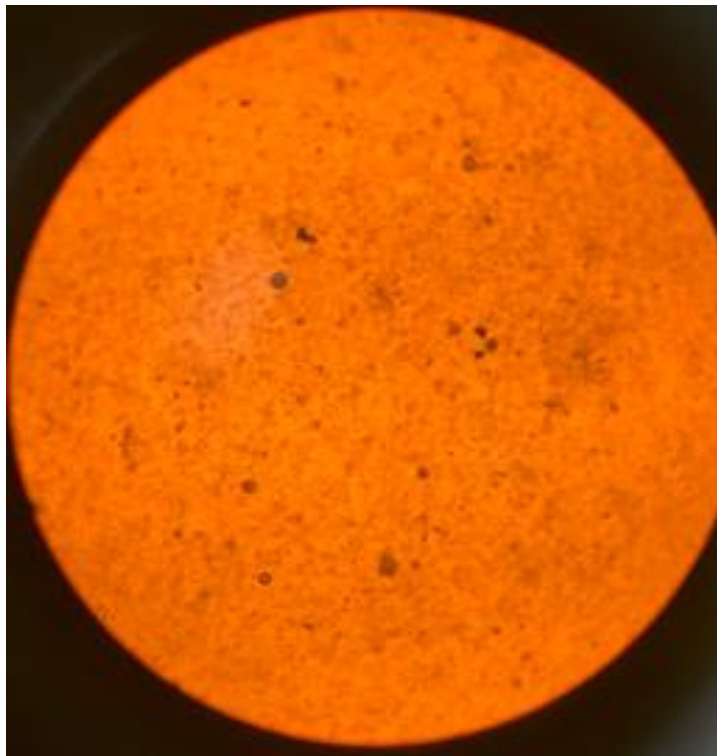


Figure 4-8: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 20 hours of BUV. 20 hours at 40x magnification

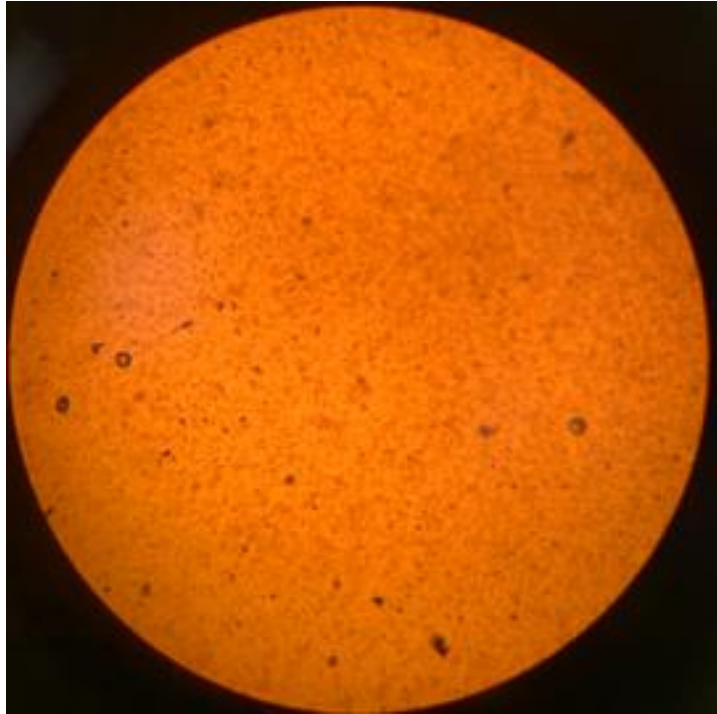


Figure 4-9: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 30 hours of BUV. 30 hours at 20x magnification

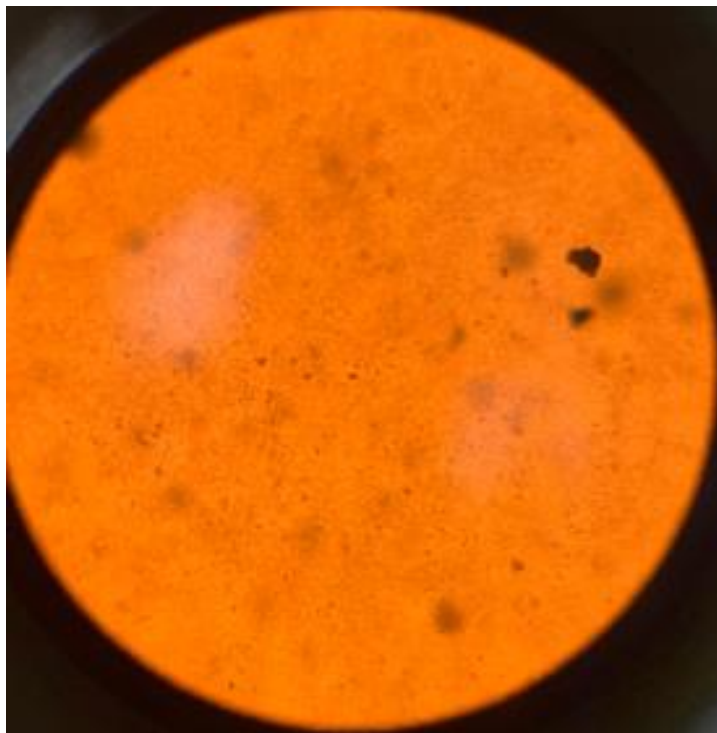


Figure 4-10: Microscope image of DCOI – UP50 Treatment 4. Unfiltered, treating solution collected directly from pilot plant after 30 hours of BUV. 30 hours at 40x magnification

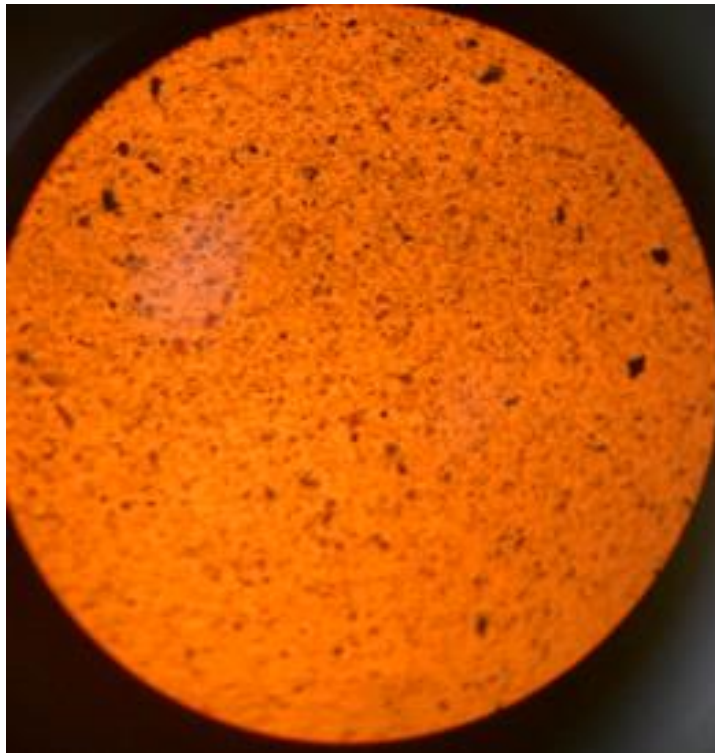


Figure 4-11: Microscope image of DCOI – UP50 Treatment 4. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 20x magnification

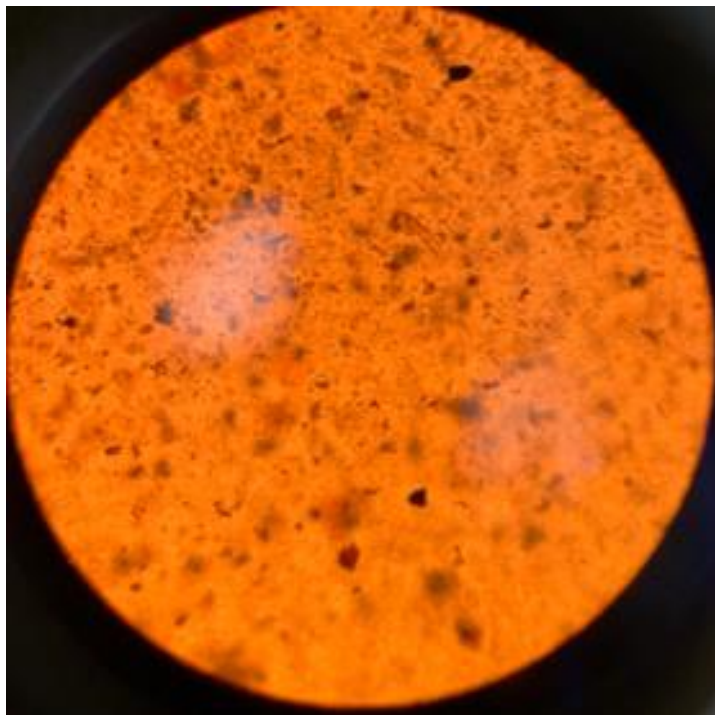


Figure 4-12: Microscope image of DCOI – UP50 Treatment 4. Unfiltered treating solution collected after final pressure and vacuum cycle. Final at 40x magnification

2. Radial and Cross-sectional images of Cookie under a microscope

In each of the DCOI experiments, cross-sectional and radial images of the cookies were captured. Based on the images from DCOI-UP50, it appeared that there were significantly fewer crystals in all of the trials.

DCOI-UP50, Cookies - Treatment 1



Figure 5-1: *DCOI – UP50*, Treatment 1. View of cross-section of cookie with a 20x magnification after it was removed from the pilot plant.

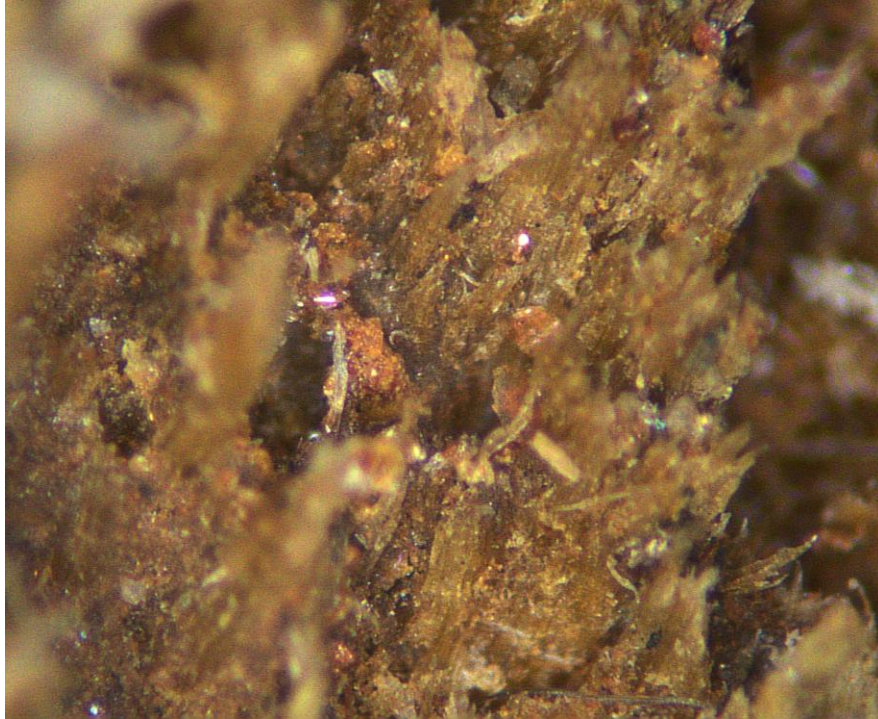


Figure 5-1: DCOI - UP50, Treatment 1. View of cross-section of cookie with a 40x magnification after it was removed from the pilot plant.

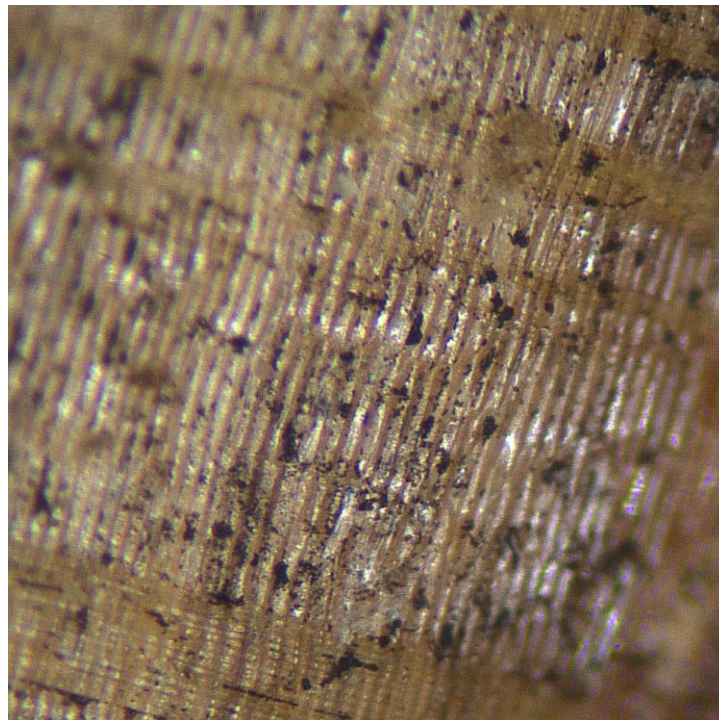


Figure 2-3: DCOI - UP50, Treatment 1. Radial View of cookie with a 40x magnification after it was removed from the pilot plant.

DCOI-UP50, Cookies - Treatment 2

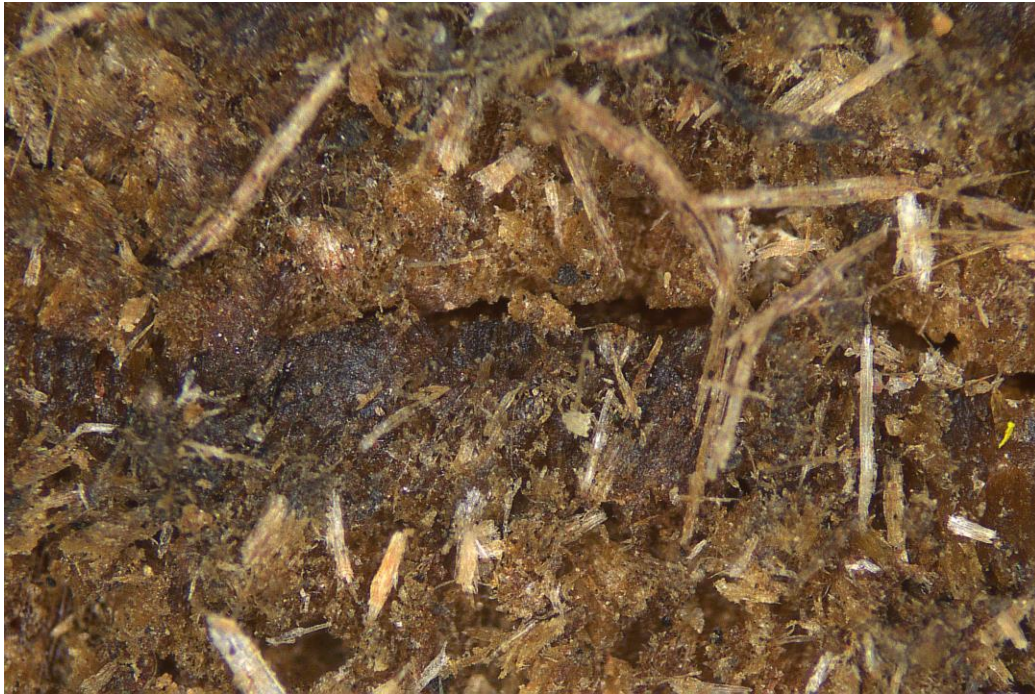


Figure 6-1: DCOI - UP50, Treatment 2. View of cross-section of cookie with a 20x magnification after it was removed from the pilot plant.

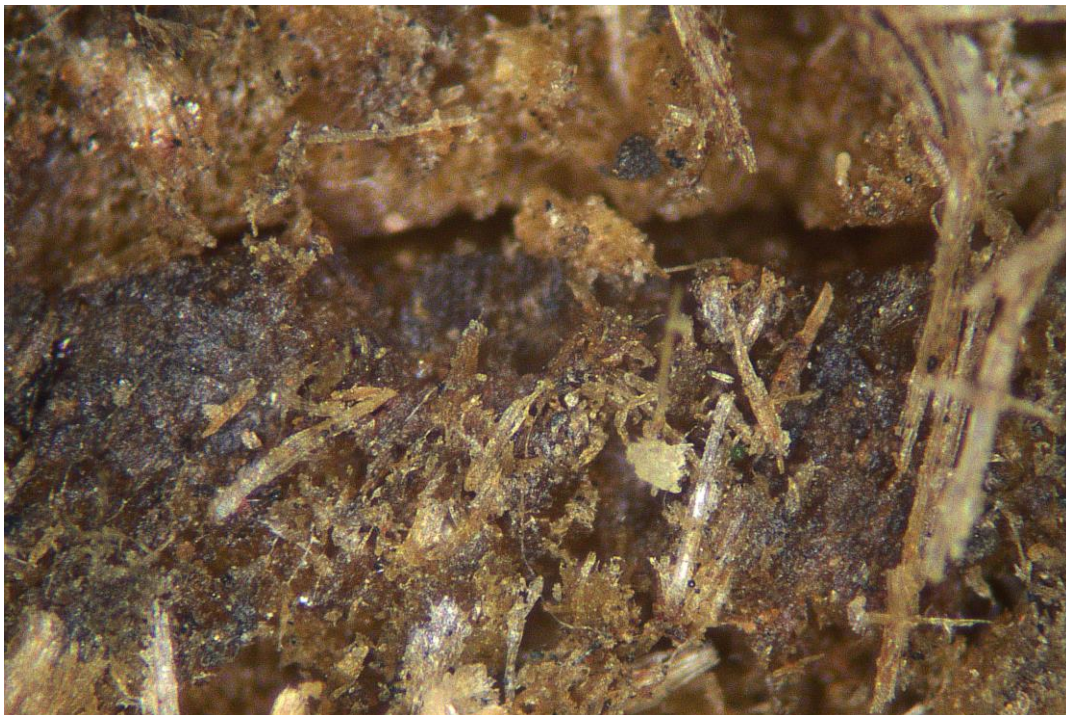


Figure 6-2: DCOI - UP50, Treatment 2. View of cross-section of cookie with a 40x magnification after it was removed from the pilot plant.

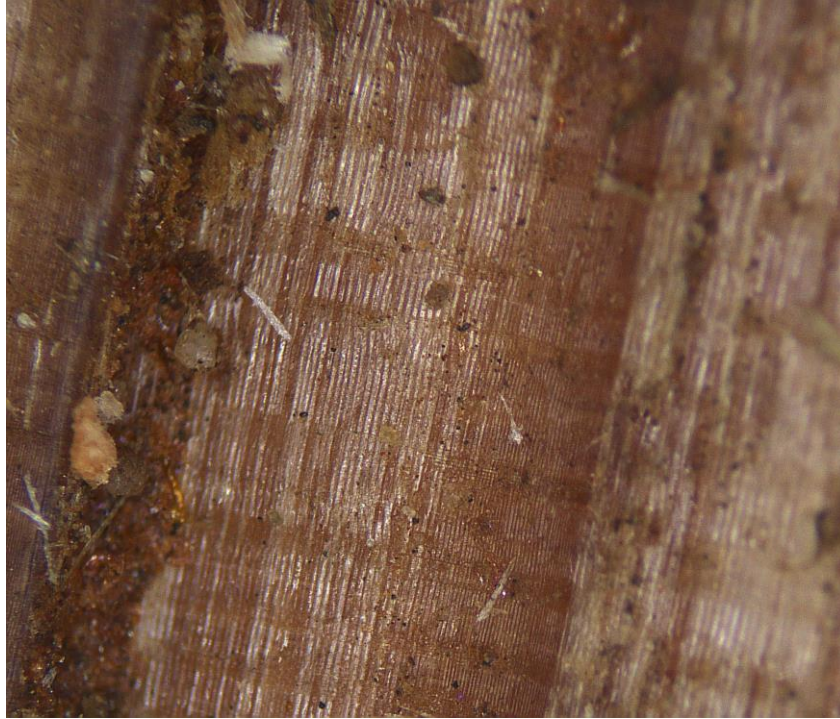


Figure 6-3: DCOI - UP50, Treatment 2. Radial View of cookie with a 20x magnification after it was removed from the pilot plant.

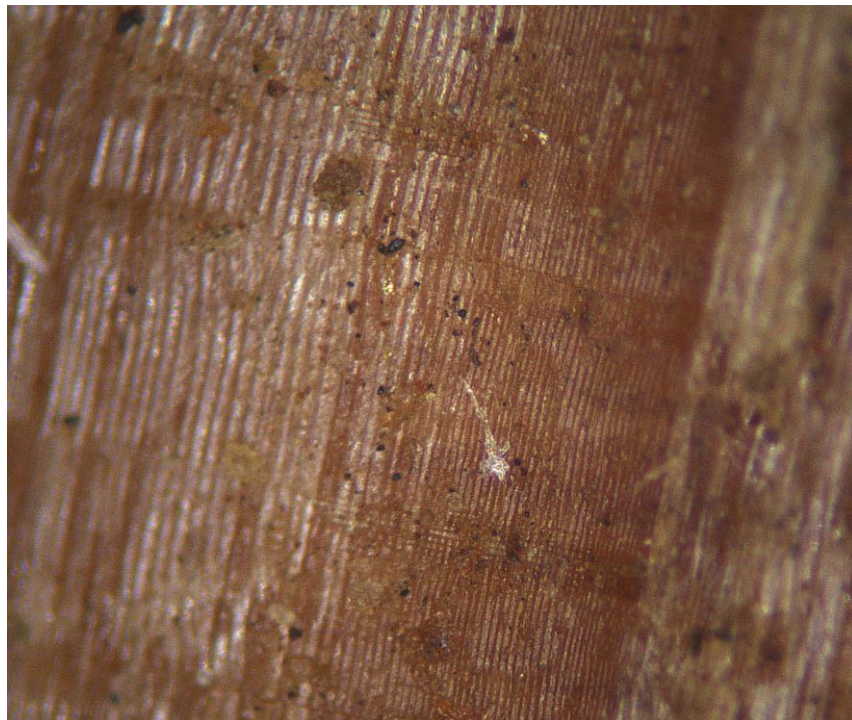


Figure 6-4: DCOI - UP50, Treatment 2. Radial View of cookie with a 40x magnification after it was removed from the pilot plant.

DCOI-UP50, Cookies - Treatment 3

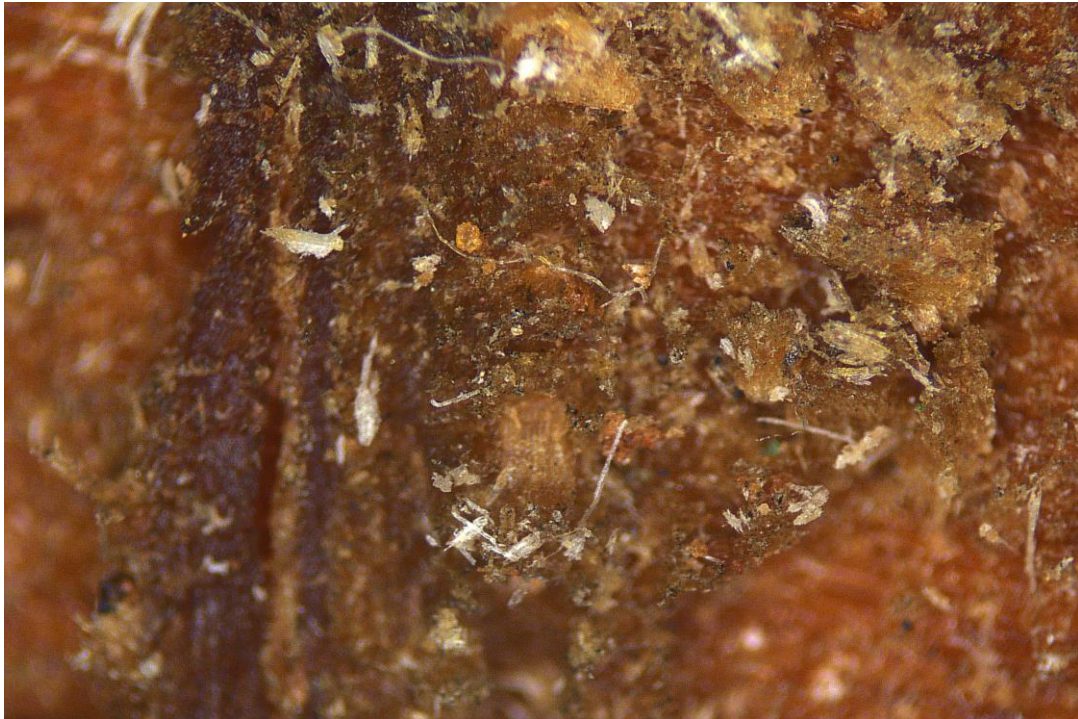


Figure 7-1: DCOI - UP50, Treatment 3. View of cross-section of cookie with a 20x magnification after it was removed from the pilot plant.

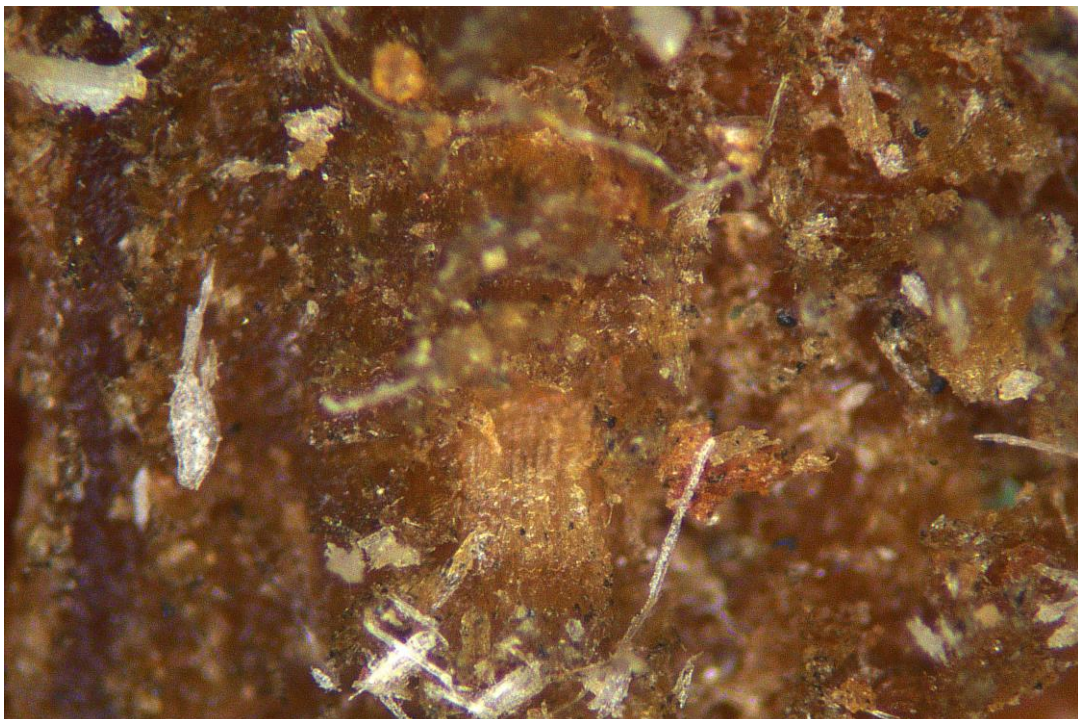


Figure 7-2: DCOI - UP50, Treatment 3. View of cross-section of cookie with a 40x magnification after it was removed from the pilot plant.



Figure 7-3: DCOI - UP50, Treatment 3. Radial View of cookie with a 20x magnification after it was removed from the pilot plant.



Figure 7-4: DCOI - UP50, Treatment 3. Radial View of cookie with a 40x magnification after it was removed from the pilot plant.

DCOI-UP50, Cookies - Treatment 4



Figure 8-1: DCOI - UP50, Treatment 4. View of cross-section of cookie with a 20x magnification after it was removed from the pilot plant.

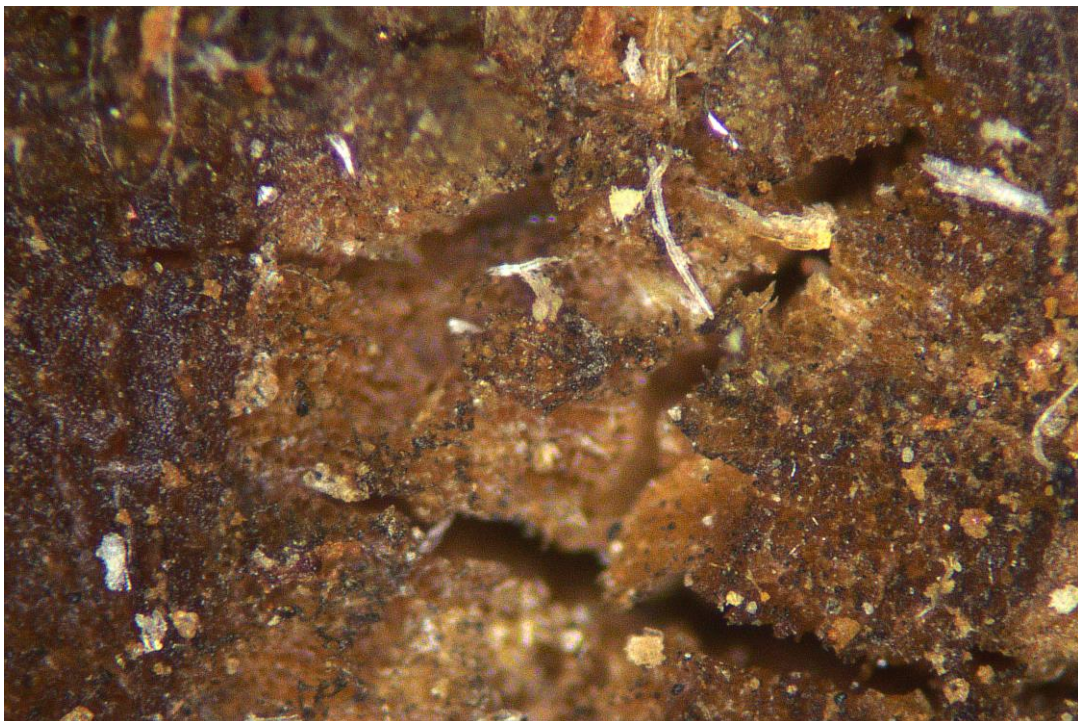


Figure 8-2: DCOI - UP50, Treatment 4. View of cross-section of cookie with a 40x magnification after it was removed from the pilot plant.



Figure 8-3: DCOI - UP50, Treatment 4. Radial View of cookie with a 20x magnification after it was removed from the pilot plant.

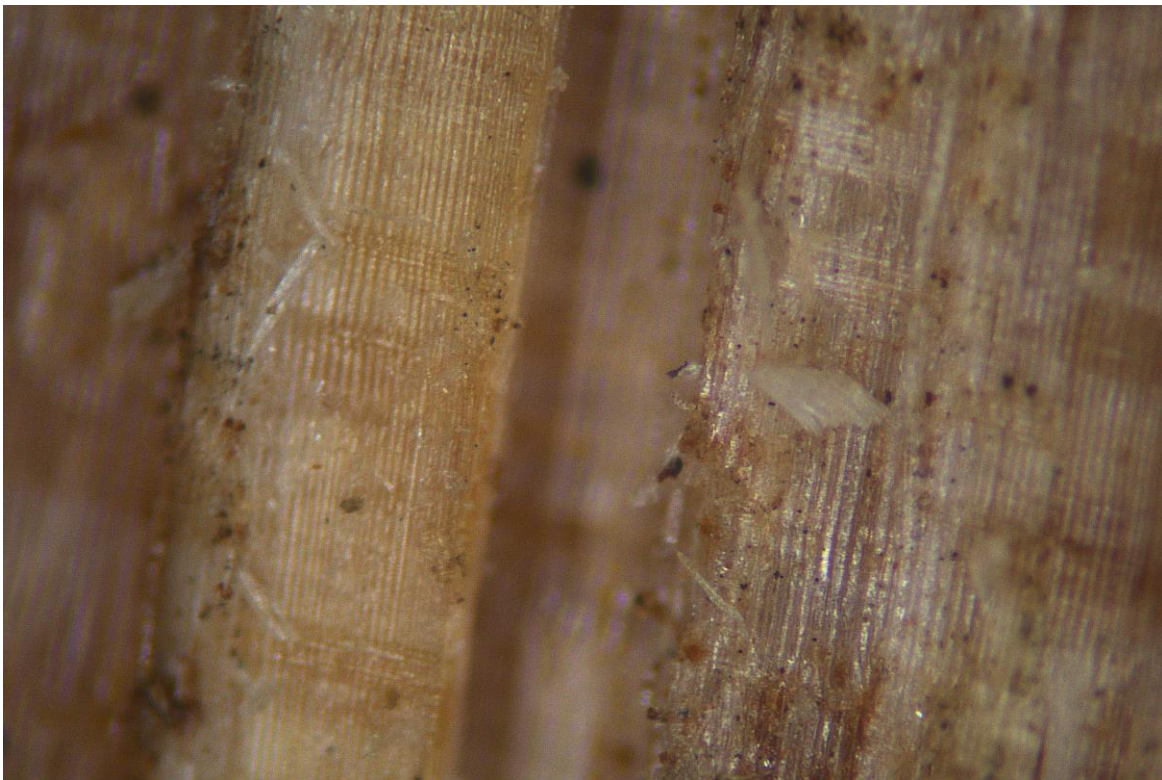


Figure 8-4: DCOI - UP50, Treatment 4. Radial View of cookie with a 40x magnification after it was removed from the pilot plant.

In both the radial and cross-sectional images of the cookie it is evident that crystals are present. However, as previously stated, the quantity of crystals is significantly less than the quantity of crystals observed in the REDACTED

3. Summary of DCOI-UP50

After four treatment cycles of DCOI-UP50 were completed, the unfiltered liquid solutions as well as the cookies cut from each pole were examined under a microscope. Unlike REDACTED REDACTED DCOI-UP50 was not filtered and therefore the filter papers were not observed. Based on the microscope photos, a separation or gel did not appear to form in DCOI-UP50. Additionally, when observing the cookies, it was noted that crystals did not form on the wood surface as seen in cookies from REDACTED

The minimum solution strength stated by Viance was 2.3% and the solution strength of each DCOI -UP50 was 2.38%, 2.37%, 2.40% and 2.42% for treatments 1-4 respectively. Therefore, each of the four treatments met the minimum required solution strength. Additionally, each of the treatment cycles reached the required retention minimums for both inner and outer zones, which were 0.1 pcf and 0.2 pcf respectively. Based on this information, DCOI -UP50 would be capable of treating the poles to meet required retentions.

Based on the results of this ongoing analysis, DCOI-UP50 was capable of treating four Douglas Fir poles without creating a gel, as well as meet the required assay retentions. Based on these observations it appears that DCOI-UP50 would be a suitable wood preservative and should undergo an upscale experiment.