VCA Optima XE Standard Operating Procedure

Version: 4 MAR 21

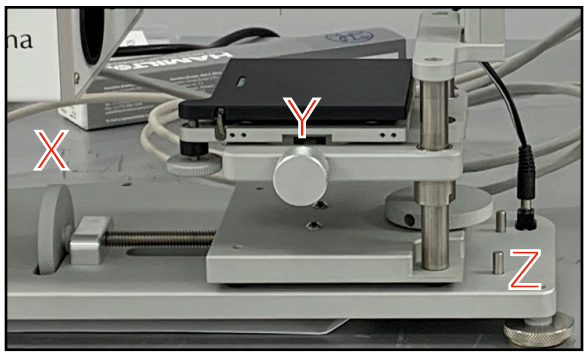
Introduction:

The VCA Optima is a contact angle measurement system that includes software features that also provide the means for measuring surface energy and other methods of analysis. This SOP outlines the basic operation of the tool. Consult the User Manual for further information.

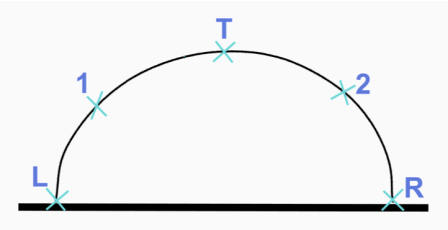
Basic Measurement Procedure:

1. Power on the VCA-OPTIMA using the *two power switches.* There is one on each end of the camera system.
2. Log in to start the VCA-OPTIMA software. A live video image of the needle will appear in the upper left hand corner of the screen. If necessary, adjust the brightness and contrast of the video image by clicking the Preview button ; the Image Adjustment window will pop up.
3. If necessary, refill or change the syringe. There are three labeled syringes to choose from with different solvents. Flammable solvents are stored in the yellow cabinet in the corner.
   a. Click the Syringe Control button . A window will pop up; click **Refill** to extract the plunger.
   b. Loosen the black syringe lock screw A on the right side of the base.
   c. Remove the syringe (pull the plunger out of the block B, then lift up).
   d. Unscrew the needle to from the syringe to remove it.
   e. If you are changing the syringe (solvent):
      i. Express the remaining solvent back into its stock 10 mL bottle.
      ii. Store the empty syringe and needle in its labeled box.
      iii. Retrieve the syringe for the desired solvent from its labeled box.
   f. Refill the syringe using the appropriate solvent.
   g. Screw the needle back into the syringe.
   h. Refit the syringe by carefully inserting the needle into the stainless tubing at the base, and then insert the plunger into the actuator B.
   i. *Lightly* tighten the black syringe lock screw A.
   j. In the Syringe Control window, set the **Droplet Size** to 0.5 µL. Then, click the **Go** button until the solvent is barely visible at the tip of the needle.
   k. If necessary, *carefully* wick away excess solvent from the tip of the needle with a wiper.

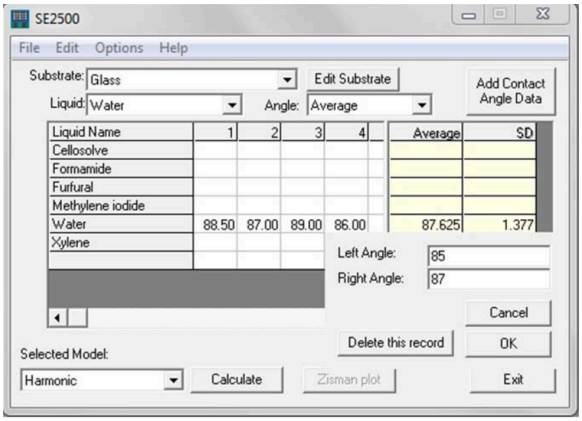
4. Using the Syringe Control button on the software tool bar, set the dispense volume. A typical volume is 2 to 5 µL. Close the control panel window when you're done.
5. Place your sample onto the stage and position it just below the tip of the needle using the X, Y and Z adjustment knobs (see image at right).
6. Using the Dispense button on the software tool bar, dispense a drop of liquid that lightly touches the sample surface. Then, lower the sample using the Z knob until the droplet separates from the needle tip.

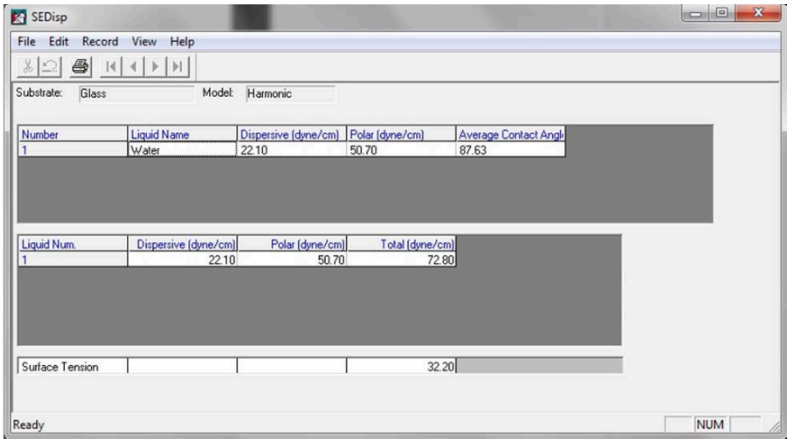


7. If necessary, center the drop in field of view using the Y adjustment knob. Focus the droplet using the X adjustment knob.
8. Click the AutoFAST button to freeze the image and automatically calculate the contact angle. Two numbers will be displayed; these are the left and right contact angles.
9. To calculate the contact angles manually:
   a. Capture a still image using the Snap Image button
   b. Use the Marker buttons to place five markers around the droplet as shown at right.
   c. Click the Manual Calculate button on the software tool bar to calculate the contact angles. This will create a curve fit and tangent line on the image.
   d. Two numbers will be displayed; these are the left and right contact angles.



10. If the contact angle is less than 15°, click the Low Contact Angle button on the software tool bar and remeasure the angles as outlined above.
11. If the sample surface is reflective, click the Reflective Surface button on the software tool bar and remeasure the angles as outlined above.
12. To calculate the surface energy:
    a. Click the SE2500 button . The table shown at right will appear.
    b. Select the **Substrate** and **Liquid** (solvent).
    c. Manually enter the measured contact angles; the average and standard deviation will be calculated.
    d. Select the calculation model:
       - Geometric Mean Method
       - Harmonic Mean Method
       - Acid-Base Theory
    e. Click **Calculate** when you have finished. The results will be displayed in the SEDisp table. See the example shown at right.





13. To save your measurements, click the Save button . Save your files to ~Documents\(Advisor)\(Your Name). This folder hierarchy will be created by the logging software.
14. When you are done using the tool, close all VCA-OPTIMA software windows.
15. Lower the sample stage and remove your sample.
16. Log out using the logging software.
17. Power off the VCA-OPTIMA using the switch on the right end of the camera system.