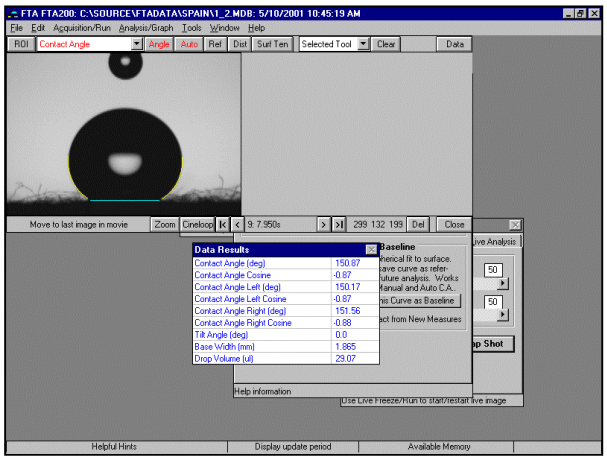
Absorption of Cotton Fabrics

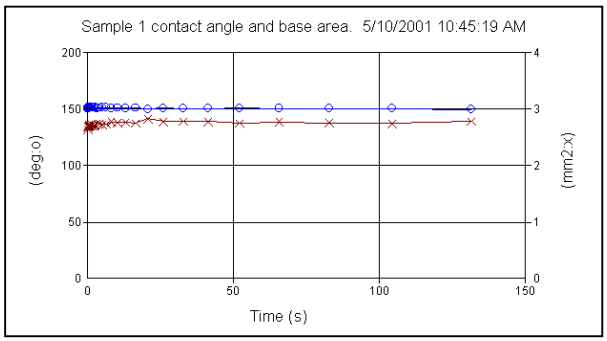
May 10, 2001

This study compared the absorption rates of water into cotton fabrics with various surface treatments. The absorption rate varied significantly from one treatment type to another, whereas the rates were similar at different locations on any one sample.

Sample 1

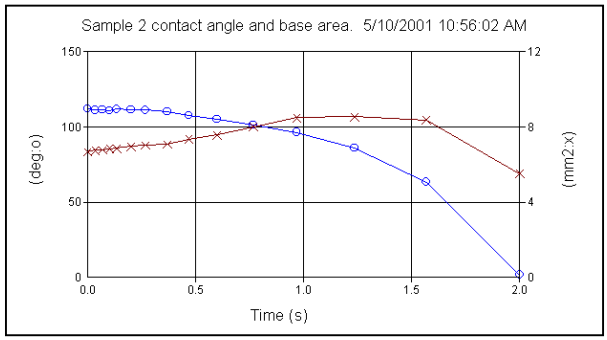
This treatment prevented water absorption and the contact angle was high, 150°. The image below shows the sessile drop just after touch-off on the surface. The graph shows contact angle and the drop's base area with time. The drop is neither spreading nor absorbing. The base area, the interfacial area between the liquid and the solid, is about 2.8mm^2 and its scale is on the right side.





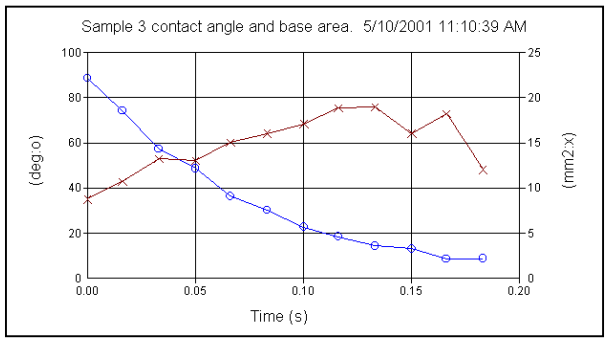
Sample 2

This treatment showed a moderate rate of absorption. The initial contact angle was 112°, but the drop absorbed completely over the next two seconds. The graph shows also that the drop spread after initial contact, from about 7 to 9mm^2. The apparent decrease in base area after 1.5s occurs as the drop disappears into the material; this should not be interpreted as a decrease in wetted area, which it is not. Instead, that portion of the drop is no longer visible above the fabric.



Sample 3

This treatment allowed extremely rapid water absorption. The entire drop absorbed within 200 milliseconds. It spread in the same way as #2, except much more rapidly. This shows the same apparent decrease in area at the end.



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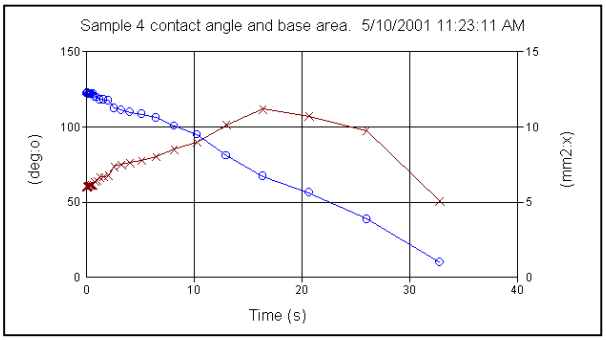
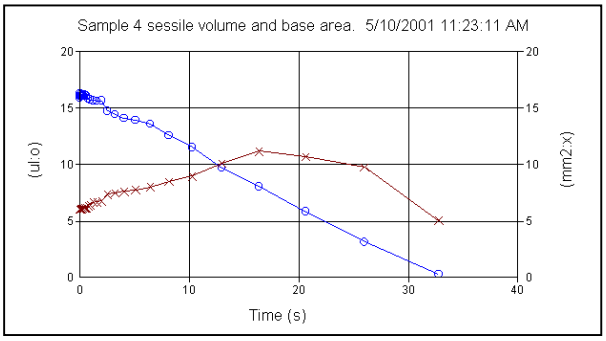
Sample 4

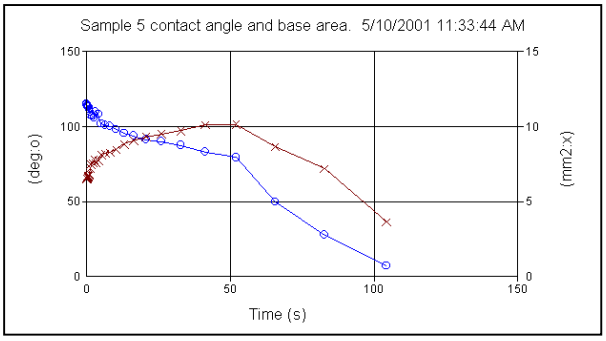
This and the final treatment show very slow, but steady, spreading and absorption. The first graph shows contact angle and base area, as have the previous ones. The second graph shows the sessile drop volume and base area (again) against time. The behavior of this drop volume is similar, except for time scale, for the other treatments which allow absorption.





Sample 5

This treatment has an even slower absorption than #4.



The final sequence of images show various stages of absorption in the drop of the graph.