

stored tubes noted that the first 0.25 inch of paste squeezed onto a toothbrush was off-color. The rest of the product in the tube met the color specification. Nothing like this had ever been seen with the original formula. Further testing showed that a person had to squeeze more product out of those tubes that had been stored at higher temperatures and/or stored for longer times before a product that met the color specifications would exit the mouth of the toothpaste tube. Tubes stored for a period of time at 40 °F contained no off-color product, whereas tubes stored for the same length of time at higher temperatures produced off-color paste.

The only exception to these results was a single tube, which had been stored at a temperature above 40 °F. A leakage of off-color product was found around the base of the cap on this tube, but the product inside the tube met the color specifications.

While other tests showed the off-color product to be safe and effective in cleaning teeth, consumers certainly would not accept a color change in a product expected to have the same color from the first squeeze to the last. Moreover, such a change could have been an early warning of more serious problems to come. This phenomenon had to be understood and eliminated before the new flavor could be marketed. Accordingly, various possible remedies were tested: caps and tubes made of different materials, different mixing methods, and so forth. None of these changes had any effect on the off-color problem. All raw materials, including the new mint flavor essence, were checked and found to meet specifications. A subsequent batch of the wintergreen product was made and tested for storage stability and, as usual, no off-color problems occurred.

Carry out a K.T. problem analysis to learn the cause of the off-color toothpaste.

- 4.19. Chocolate butter paste is the primary ingredient used by a number of major bakeries for a wide variety of pastries. The paste is a very viscous liquid that is manufactured by Cocomaker Industries in a major populous city in the Midwest. Cocomaker supplies customers as close as Dolton and as far away as Chicago (which is a long drive from its plant). The paste flows from the production line into five-gallon drums, which are placed immediately into refrigerated trucks for shipment to the respective customers. Until February, all the trucks had been the same size and the drums were stacked in rows three drums wide, four drums high, and eight drums deep. Now two rather small customers, Bell Bakery and Clissold Bakery, each requiring 20 drums per day, have been added in the Chicago area. Supplying these new customers, along with an increased order by the Chicago customer Hoyne Industrial Bakers, necessitated the purchase of a larger truck. The new truck could fit five drums across, four drums high, and eight drums deep. The truck would stop at Bell and Clissold just before and just after stopping at Hoyne in Chicago proper. With the increased market in the Chicago area, Cocomaker's plant is running at close to maximum capacity. Because the ingredients of the paste are mixed by static mixers, the pumps are currently operating at their maximum capacity and the plant is operating 20 hours per day.

In November, Cocomaker successfully lured two nearby customers, Damon Bakery and Oakley Bakery, away from one of its competitors. By increasing plant operation

