

# HEALTH BARS - A CONFECTIONARY CHALLENGE

## sensory experience

Manufacturers of health bars want their customer to feel that the eating experience can be as exciting as a scrumptious chocolate candy bar. Therefore the ingredients that they use for flavorings and mouth feel must produce a similar sensory experience. The important physical test parameters in evaluating new formulations for health bars are texture and viscosity. Texture is assessed using an instrument called a Texture Analyzer that can measure hardness and chewiness. Viscosity is evaluated with either a Viscometer or Rheometer, but the latter has more capability to characterize pseudo-chocolate coatings and quasi nougat-fillings for mouth feel and swallowing.

Texture Analyzers and Rheometers (see Figure 1) are being used with increasing frequency in both R&D and QC by the health bar industry. Texture Analyzers perform cutting and bending tests on health bars, giving a sense of the customers' first impressions when taking health bars out of the wrapper and making the initial bites. Rheometers measure the consistency of the ingredients that bind the bar together and the exterior coating that gives it that appetizing appearance. This combination of instruments has become the essential tools for the successful manufacturer in everyday production to ensure guaranteed quality and a happy customer base.

### TEXTURE ANALYSIS

Figure 2 shows typical examples of tests that are performed by a Texture Analyzer. The instrument is basically a device that controls the movement of a probe used to deform the sample being tested. The Texture Analyzer measures the force load resistance as the probe makes contact with the food item. In Figure 2a the health bar is snapped in two as the blade moves downward into the sample. Figure 2b shows the candy is penetrated by the punch probe. Rate of probe movement and depth of penetration are the control parameters. The force measured by the instrument as a function of time and/or penetration distance is the data output.

Figure 2c shows a cutting test performed on an energy bar. The blade cuts through the bar at the speed of 1 mm/sec. The Texture Analyzer has a 10kg load cell (which can measure up to 22 pounds force). Figure 3 displays the data curves for three different energy bars that were tested with the cutting blade. The maximum force during the cutting action is called "Peak Load". The hardest bar is made up of double chocolate protein with a peak load that exceeds 9000 grams while the easiest to cut is the pure chocolate brownie with a peak load around 2500 grams.

R&D will conduct this type of cutting test on various formulations for health bars until a specification for acceptable peak load is agreed upon. A window for minimum and

**Figure 1a: CT3 Texture Analyzer with confectionery jig.**



**Figure 1b: Brookfield RST-SST Rheometer**



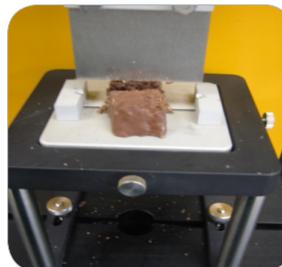
**Figure 2a: Bend Test on Health Cracker**



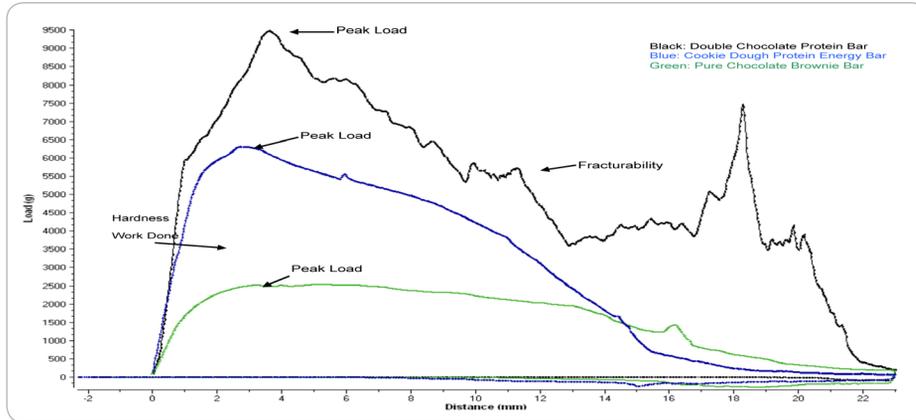
**Figure 2b: Hardness Test on Malted Milk Ball**



**Figure 2c: Cutting Test on Energy Bar**



**Figure 3: Graphs for Cutting Tests on Three Energy Bars**



maximum allowable force loads will be established as part of the spec. This criterion then becomes the QC spec for testing on each batch of bars that are produced by manufacturing. If the measured peak load does not fall within the window, the batch is at risk of being rejected. Marketing Departments insist on these new QC methods to ensure that customers will enjoy the “right” mouth feel when biting into and chewing the bar.

### **VISCOSITY MEASUREMENT**

Chocolate or its equivalent is a preferred coating for health bars based on consumer surveys that evaluate what entices a person to choose one product over another. Industry has established viscosity test methods that characterize the flow behavior of the chocolate coating. In the USA, the National Confectioners Association has prescribed the use of coaxial cylinder geometry (cylindrical spindle rotating in a cylindrical chamber) to measure the viscosity of tempered chocolate at discrete rotational speeds. The instrument shown in Figure 1b is equipped with coaxial cylinder geometry. International standards organizations have similar test methods, so it is fair to say that the worldwide industrial market has agreed on this general approach to the measurement of chocolate viscosity.

Rotational speeds used to measure viscosity typically range between 1rpm and 100rpm. Rotational speed is directly proportional to a scientific parameter called “shear rate”. Shear rates of interest are traditionally also between 1 and 100 reciprocal seconds. The viscosity data at multiple shear rates is analyzed in a plot that shows shear stress (the parameter measured by the rheometer which is proportional to viscosity) vs. shear rate. A math model will reduce the data to a straight line, the slope of which is referred to as “plastic viscosity”. This line is extrapolated to the y-axis which gives a shear stress value equivalent to zero shear rate. This value is referred to as the “yield stress” for the chocolate.

Industry has used this method for many years, both in R&D when characterizing new formulations, as well as QC to confirm compliance with established specifications.

### **CONCLUSION**

The important takeaway from these test methods is that the best choice for instrumentation is equipment that can work in R&D with dedicated software for the initial characterization of your products, but can then work in standalone mode without software in the QC Lab to provide the pass/fail numbers needed for product acceptance. When speaking with instrument manufacturers, be sure to cover both aspects of how their instruments work. Ultimately involve your technicians/operators in the selection process for the equipment. They can provide the important “know-how” related to ease of use and time required to run a specific test. When the purchase decision is finally made, you will have automatic acceptance by personnel in both R&D and QC, which guarantees that the test plan to ensure the quality of your health bars will move forward with confidence.

Authors: Robert McGregor, General Manager, Global Marketing/ High-End Lab Instrument Sales  
Brookfield Engineering Laboratories, Inc. 11 Commerce Blvd., Middleboro, MA 02346  
Tel: 508.946.6200 Fax: 508.946.6262  
Email: r\_mcgregor@brookfieldengineering.com Website: www.brookfieldengineering.com