

The low - or is it high? - shear of a process known as conching helps enhance the flavor and texture of chocolate. Or does it?



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Continuous Mixing. Continuous Expertise.

by John Gregerson, Managing Editor

Ever wonder how fine chocolate achieves that smooth, melt-in-your-mouth mellowness that's virtually unmatched in the world of confections?

Well, chocolate makers aren't sure themselves. Or if they are, they aren't telling.

Like most processed foods, chocolate is primarily a product of science, save for one critical step, conching, which reputedly enhances the finished product's flavor and texture. But academic literature on conching, so named for the shell-shaped container once used for the process, is rife with contradictions, and further inconsistencies between the literature and practical observations are as ubiquitous as chocolate itself. In one instance, during a workshop at Pennsylvania State University, Dr. Gregory Ziegler, an associate professor of food science, assembled 20 professionals, all members of the confectionery industry, to conduct a triangle difference test using conched and unconched milk chocolate. The results? "No one could detect a difference between the two," he says. The same, he adds, was true of taste tests conducted at the Fraunhofer Institute in Germany. "Our colleagues in Munich couldn't tell the difference either."

The fact that conching has been used to describe everything from slow mixing to high-shear heating and mixing has only served to confuse the issue.

So just what is conching? And how does it achieve all that is purportedly does?

In simple terms, conching transforms chocolate mass from a powdery aggregate to a fluid. "Traditionally, it's been associated with low-shear operations of long duration, though shear rates have increased over the years to shorten the process," Ziegler says.

The powder used to begin conching derives from a set process in which cocoa beans are roasted, crushed,

blended and then ground. During grinding, the "nib" - or meat - of the bean liquefies into a paste known as cocoa liquor, which contains cocoa butter, a natural fat, and the dry matter of the bean. The cocoa liquor is then mixed with sugar (and milk for milk chocolate) and refined to a powder.

Next comes conching, during which the powdery mixture is heated and emulsifiers and additional cocoa butter are added to liquefy the mixture and allow that full chocolaty flavor and texture to develop, though not necessarily in ways that are well understood. Traditional conching puts chocolate through a type of kneading action; the conches are equipped with heavy rollers that plow back and forth through the chocolate mass. Depending on their speed, the rollers produce varying degrees of agitation and aeration that presumably develop and modify chocolate's flavor and texture. The method is based on a traditional Mexican practice that chocolate-maker Rudolphe Lindt adapted in the late 19th Century to rid his products of their sharp, gritty flavor and texture. But in general, Lindt's method isn't used much anymore, Ziegler says. "The rollers initiated a low-shear, reciprocal action that could take days", he says. "Among the types used today, rotary conches are probably the most typical. They feature agitating blades that work the material in a longitudinal motion, and their shear rates are considerably higher, just as their processing times are a good deal shorter."

Sinfully good? Or just good?

Few confections are as shrouded in myth, mystery and misunderstanding as chocolate. It's sinfully delicious, to be sure, but is chocolate really as guilty a pleasure as it's purported to be?

Apparently not, in recent years, science has done much to melt some of the myths surrounding chocolate and health.

Take the assumption that chocolate raises cholesterol. Although saturated fats typically increase cholesterol in our bodies, stearic acid, the main saturated fat in chocolate, does not raise blood cholesterol levels. In fact, studies suggest that chocolate not only doesn't raise low-density lipoprotein levels (LDL or "bad cholesterol"), but actually increases high-density lipoprotein levels (HDL or "good cholesterol").

As for the purported link between chocolate and acne, studies by the Pennsylvania School of Medicine and the U.S. Naval Academy both found that acne is not related to chocolate consumption.

Nor does consumption of chocolate promote "hyper" behavior in kids, according to the U.S. Food and Drug Administration and 1988 Surgeon General's Report on Sugar and Health.

Not even with all the caffeine it contains? The truth is, chocolate doesn't contain high amounts of caffeine. In fact, the amount in a typical 1.4-oz. bar or 8-oz. glass of chocolate milk is equivalent to a cup of decaffeinated coffee with 6 mg. caffeine.

It's worth remembering that along with fats, oils and sweets, chocolate is at the tip of the food guide pyramid. And as we all know, too much fat causes weight gain and related problems such as heart disease, diabetes and obesity. So it's okay to feel just a little guilty.

A mixer from Readco can take as little as 10 minutes to perform conching on a batch of chocolate.



Theories and more theories

But no one is sure exactly how conching enhances flavor and texture. One theory holds that the process makes particles more uniform in shape and reduces their size, thus exposing more and more particle surface to cocoa butter. Hence, the smooth, rich texture. Others contend that conching doesn't necessarily result in a smaller particle size, but more probably rounds out the rougher edges, thereby promoting a smoother mouthfeel. Ziegler's take? "We think that conching disperses agglomerates in the mixture, and believe it's that physical change - dispersion - that makes the conched chocolate behave differently in the mouth than unconched chocolate.

"It's probably a combination of factors," says Terry McCoy, sales group leader with Readco Kurimoto, Inc., a York, PA-based supplier that, with some assistance from Ziegler, modified a twin-shaft, co-rotating mixer it manufactures to perform continuous conching. "Our own equipment, which features a paddle configuration, reduces particle size from 100 microns to 20 microns. The narrower the range of particle size, the better the chocolate." McCoy says.

Ziegler's own research suggests that in addition to texture, deagglomeration may also influence flavor through its influence on rheology. Some chocolate makers contend that flavor is further enhanced by a reduction in acidity that occurs during conching. Ziegler isn't so sure. "Over the years, there have been numerous attempts to discover that 'great chemical reaction,' such as acid reduction, that would help explain what actually occurs during conching. But our own investigations show that the acidity levels in chocolate remain unchanged after conching." So do moisture levels, he contends, despite claims that a principle outcome of conching is dehumidification of the chocolate mass.

It simply may be that the changes chocolate undergoes during conching are subtle changes, Ziegler says, or that results vary according to ingredients, methods, temperatures and other variables.

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It's ironic, he says. "On the one hand, conching is considered a hallmark of quality chocolate. On the other, not a whole lot seems to be happening."

But it does seem to be happening faster. The mixer that Readco and Ziegler collaborated on takes as little as 10 minutes to complete a batch, depending on the application. "In general, continuous conching provides processors with numerous advantages", McCoy says. "One of the biggest drawbacks of the traditional conch is the time required to fill, empty and clean the equipment. Moreover, several conches must run simultaneously to match continuous production lines in the remainder of the plant. As a result, batches are starting and finishing all the time. Continuous conches, by comparison, require far less floor space and capital investment for equipment, and often result in lower energy cost", McCoy says. "As a totally enclosed process, they also improve sanitation".

In some plants, an emulsifying operation takes the place of conching or is used to supplement it. In such cases, equipment that resembles an eggbeater breaks up sugar crystals and other particles in the mixture, resulting in a finely-grained, very smooth chocolate.

Or is that open for debate too?

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For more information contact Readco Kurimoto at 717-848-2801.