Homogenization of tomatoes
– two-stage process decreases wear on homogenizer and dampens vibrations.

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Tomato products all have one thing in common – they are highly abrasive and this will cause substantial wear on your homogenizer. Choosing the correct wear-resistant materials when the homogenizer is configured is a must, and so is finding the optimal homogenizing pressure to give your end product the desired properties. There is also a third way to reduce wear, minimize maintenance and increase uptime: using a second homogenization step when processing tomatoes has shown to be an efficient way of obtaining the same product quality with substantially lower wear on the homogenizer.

Cavitation could be described as a two-edged sword. The good side is that it creates the turbulence needed to homogenize the product. The bad side is that when it occurs in the wrong place, it will wear down even the most resistant materials in a homogenizer.

Cavitation occurs in the product when homogenizing pressure drops from perhaps 200 bar down to less than one bar in a matter of microseconds. With the rapid pressure drop, cavities – bubbles – of gas will form in the product. When these collapse they set strong turbulent forces free and it is these forces, not the pressure, that break down the particles and fat globules in the product. The problem with cavitation is that it is hard to control, and when a lot of cavitation takes place close to the walls in the homogenizing gap, they will quickly cause wear on the machine. This will, in turn, lead to shorter uptime and a constant need for replacing parts at short intervals. This is a well-known fact when running an abrasive product such as tomatoes through a one-step homogenizer. For these products it is of course imperative not to over-homogenize, i.e. use an unnecessarily high homogenization pressure, since that will wear down the parts even faster. But there is also a way of controlling cavitation by using a second stage homogenization, which will further reduce the wear on the machine.
When the pressure drops within microseconds, gas cavities form in the product. The implosion of these is what causes cavitation, leading to turbulence that breaks down particles and fat globules.

The basic function of the second stage is that it keeps a controlled and steady pressure on the backside of the first stage. This means that the gas cavities will be kept in the bulk of the liquid and away from the walls.

The second homogenizing step adds pressure on the backside of the first homogenizing step, which controls the cavitation.
The ideal pressure of the second homogenization step is different for different products, but the ideal level for tomato products has shown to be somewhere in the range of 20 – 40% of the first homogenizing step.

It must be noted that the homogenization effect of the second stage is very small compared to the first stage, but there are two advantages. The two-stage homogenization allows the wear parts of the homogenizer to last up to 20% longer and the two-step drop in pressure also means a substantial reduction of vibrations, which decreases risk of wear and material fatigue on the processing components downstream from the homogenizer.

For tomato products, the homogenization pressure of the second stage should ideally be between 20 and 40% of that the first stage. Note that our definition of homogenization pressure $P_1$ is the pressure measured before the first homogenization stage, while $P_2$ is the pressure between the first and the second homogenization stage.

One might argue that a two-stage homogenizer means a higher investment cost and more parts to replace. This is true, but experience from a large number of installations has shown that the accumulated wear will be substantially lower than in a one-stage homogenizer. And since the wear parts of the first and the second stage are the same, they can easily be interchanged to further increase their lifetime. In the long run, a two-step homogenization of tomato products and the reduced wear coming with it, will mean a reduced total cost of ownership for tomato producers.

So, to conclude – two-stage homogenization of tomato products means

- Less wear on the homogenizer
- Up to 20% increased lifetime of critical parts
- Less maintenance and service
- Reduced vibrations, saving downstream equipment.
- Reduced total cost of ownership