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THE SCIENCE OF MAKING MAYONNAISE ON AN INDUSTRIAL SCALE

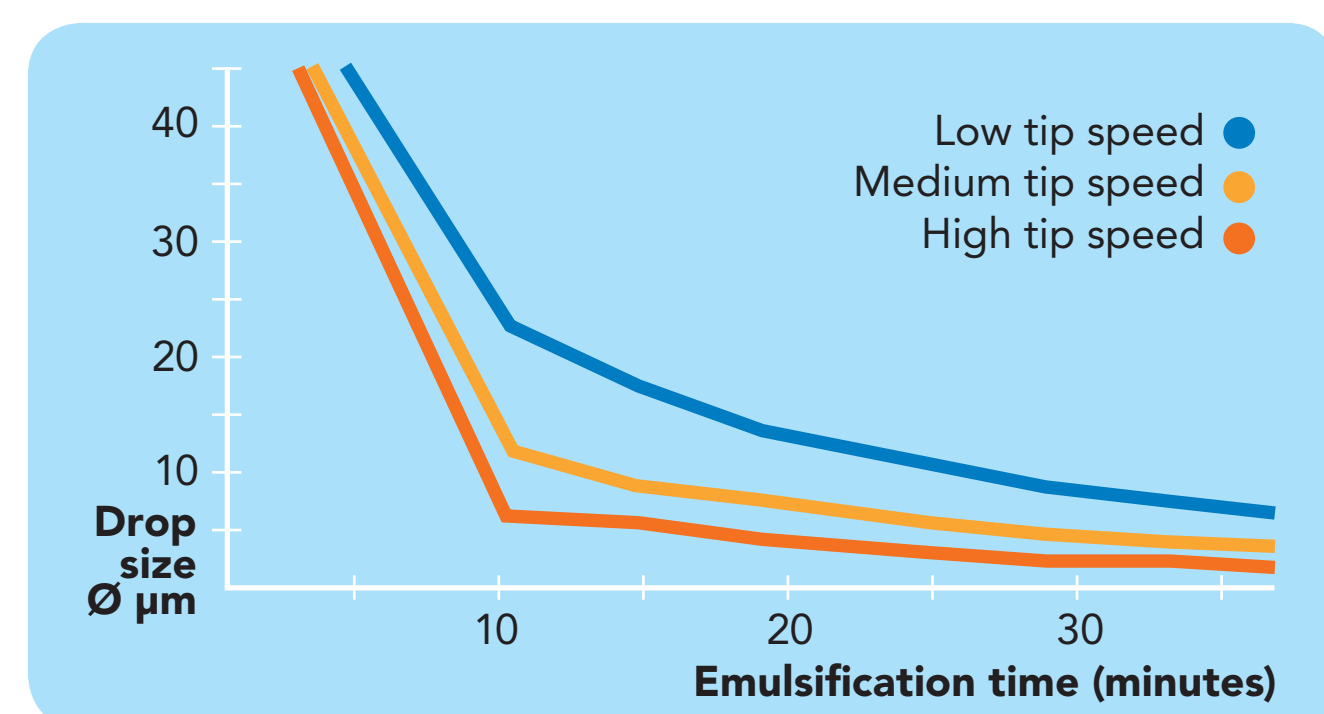


Creating a creamy and thick mayonnaise successfully at home in a kitchen is fairly easy – but how do you do this efficiently in a batch size from 500 kg to 2,500 kg? What parameters can you play with to get the texture of mayonnaise just right? The crucial factors manufacturers need to control for consistent product quality are:

- Mixing time and intensity
- Oil addition rate
- Drop break-up
- Effects of varying the recipe

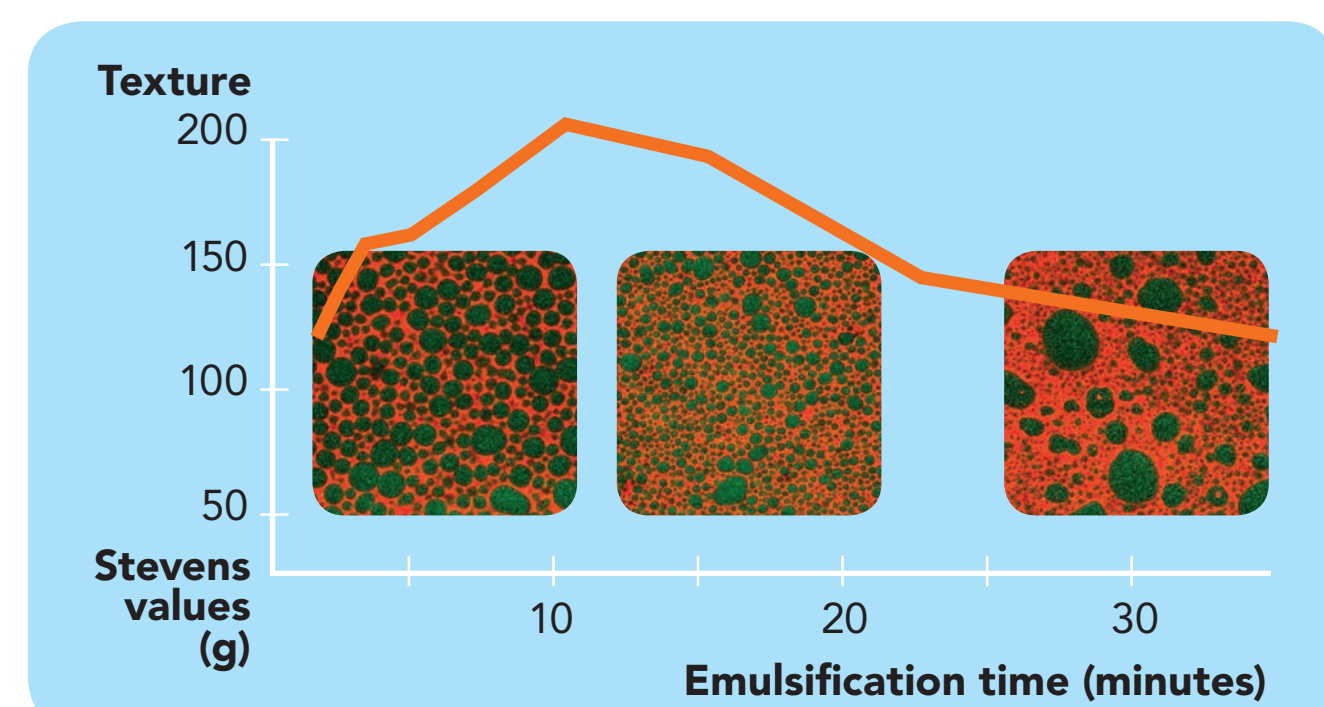
MIXING TIME AND INTENSITY

The more intense and longer the emulsification time, the smaller the droplet size, as the graph shows.



Knowing how texture is built up during emulsification and how to reach the preferred texture level or maximum consistency helps producers to stay in control of their process.

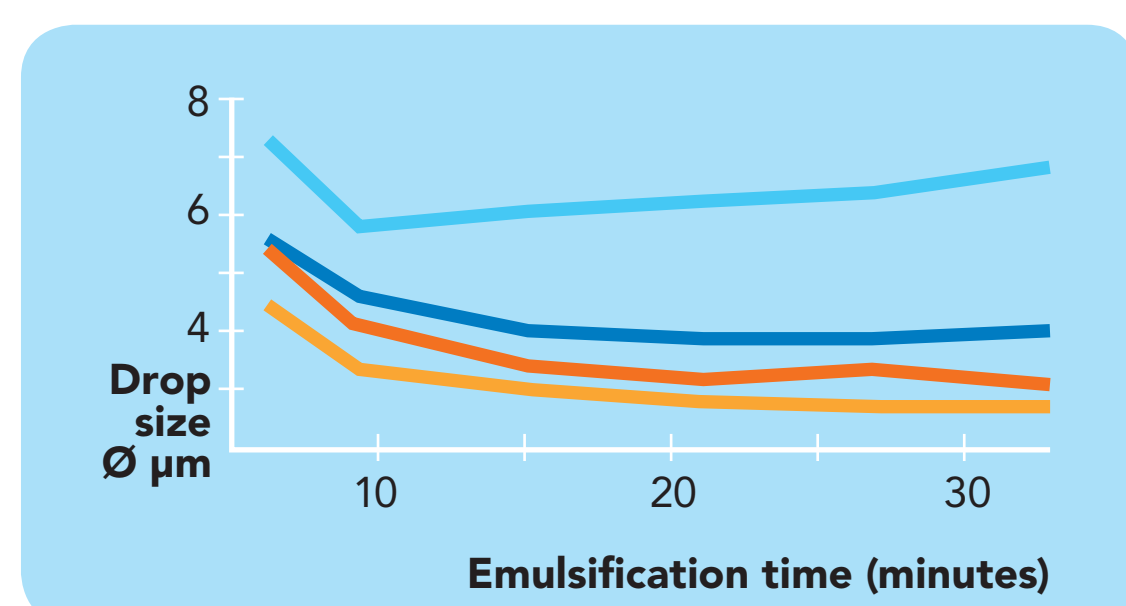
The texture of mayonnaise, the main quality parameter, shows a clear peak as you can see in the graph below. With prolonged mixing time, over-shear will occur, as the functionality of the egg yolk slowly deteriorates.



EGG TYPE INFLUENCES DROP SIZE

Mayonnaise quality is a combination of the recipe and the process. Different drop sizes and textures can be produced by varying amounts of yolk and whole eggs.

Note that the mayonnaise recipe in the graph below consisted of 79% oil and 7.9% egg, where the egg type was the variable. When only egg yolk were used, this gave the smallest droplet size in contrast to the largest droplet size from whole egg.

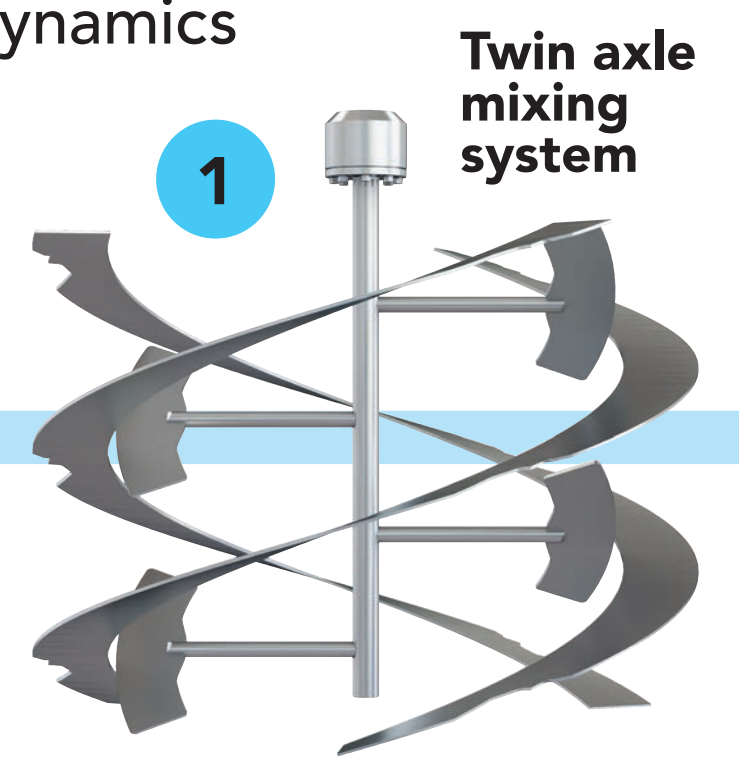


- 30% yolk, 70% whole egg
- 50% yolk, 50% whole egg
- 100% whole egg
- 100% yolk

KEY TECHNOLOGY FOR EFFICIENT MIXING

Tetra Pak® High Shear Mixer has a dynamic rotor stator system combined with a very efficient twin axle mixing system inside the vessel.

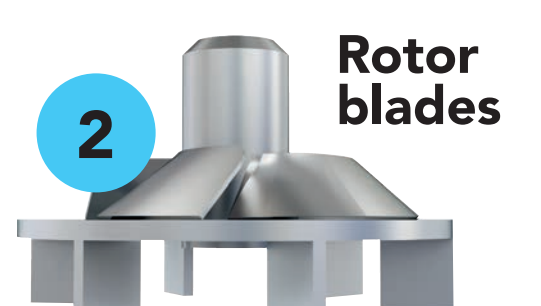
This design has been validated by computer fluid dynamics (CFD) to ensure that there is a homogenous tank flow throughout the vessel – required for making consistent mayonnaise quality.



OIL ADDITION RATE AND BATCH TIMES

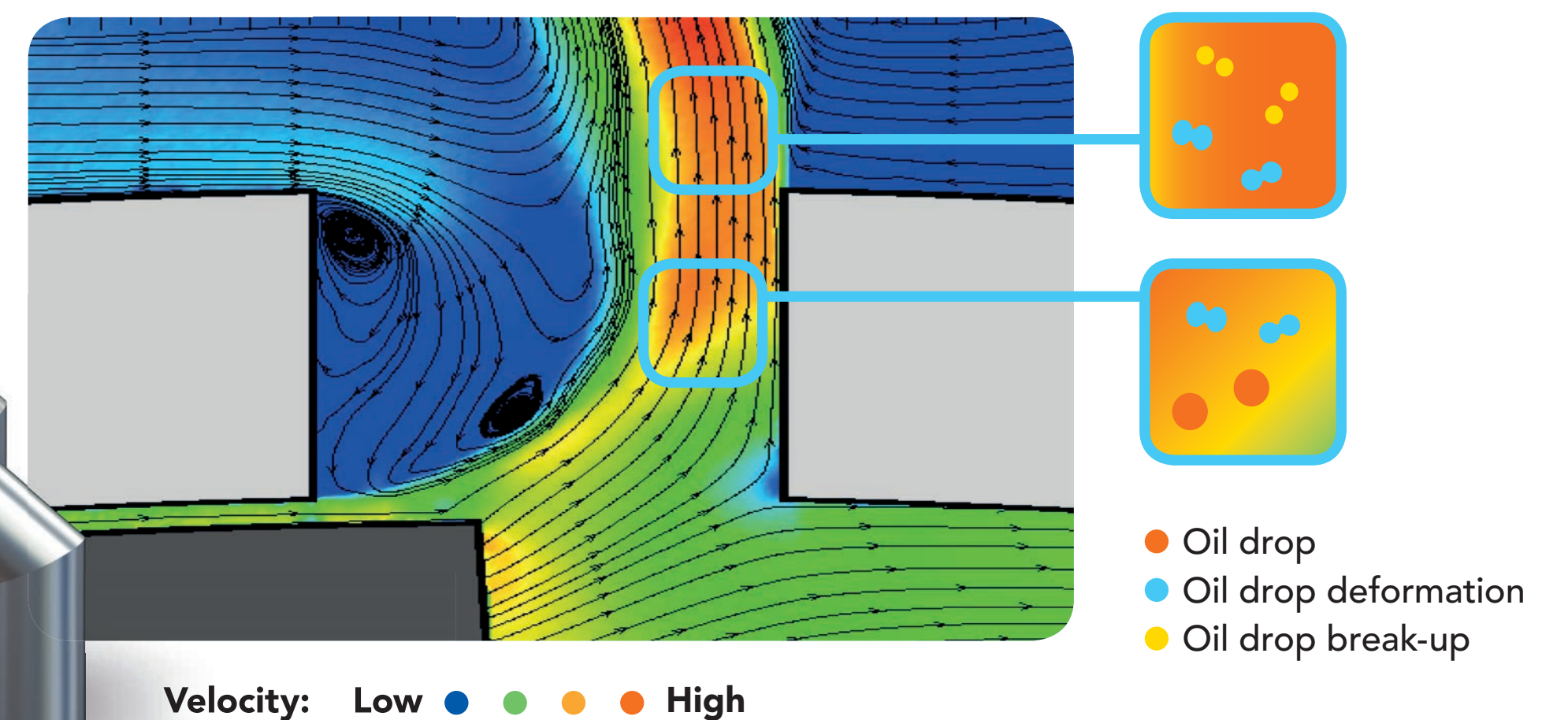
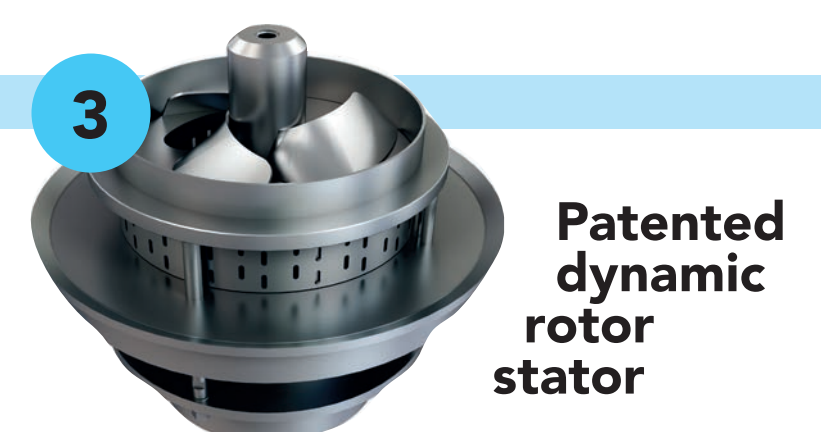
How fast can oil be added without breaking the emulsion? The very high flow through a Tetra Pak® High Shear Mixer tank makes a higher oil flow possible while still achieving consistent product quality.

A high oil flow rate gives much shorter batch cycle times compared to conventional systems and thus more cost-efficient production.



DROP BREAK-UP

The drops are deformed and broken down in the high-speed jet formed in the stator holes. PIV visualization was used to show the exact positions where the drops were broken down in order to understand the break-up mechanism better.



HIGHER FLOW ► HIGHER OIL ADDITION RATE ► SHORTER BATCH TIMES ► CONSISTENT PRODUCT QUALITY



The solution to get the right balance between ingredients, shear and mixing time has been developed into a unique prediction tool. Based on hundreds of trials on mayonnaise and dressings, at different scales, we have built up a software programme specially designed for Tetra Pak® High Shear Mixer.

This tool can fine-tune mixing configurations and process parameters depending on the recipes and specific customer requirements.

The mixing process is controlled in such a way as to guarantee consistent product quality, regardless of the scale of production. By taking into consideration a palette of parameters, the mayonnaise quality can be adapted to a customer's needs.

This tool enables manufacturers to achieve a shorter time to market for new emulsified sauces and dressings when the desired texture or drop size can be predicted for a specific industrial scale.