

Solutions for Your TOUGHEST
MIXING Applications in

FOOD

Introduction

Mayonnaise Manufacture

The Process

The Problem

The Solution

The Advantages



Mayonnaise Manufacture

Mayonnaise is an oil-in-water emulsion which can contain up to 80% oil. Some typical recipes would be as follows:

80% Oil Formula

Vegetable oil	80%
Egg yolk	6%
Vinegar	4%
Sugar	1%
Salt	1%
Spices (e.g. mustard)	0.5%
Water	7.5%

Low Fat Formula

Vegetable oil	50%
Egg yolk	4%
Other thickeners	4%
Vinegar	3%
Sugar	1.5%
Salt	0.7%
Spices	1.5%
Water	35.3%

Gums and thickeners such as starches are used in low fat products to replace the viscosity and bulking effect of the oil, to enhance mouthfeel, and to ensure that a stable emulsion is formed.

Large scale production is normally carried out using plant specifically designed for mayonnaise manufacture. This process is often semi-automated. For R&D, pilot scale and small scale production typical of the “ready to use” market - sandwich producers, caterers and other low-volume applications - mayonnaise needs to be produced in a manner which allows much more flexibility, especially when changing formulae.

The Process

A typical method for manufacture of mayonnaise would be as follows:

- In the first stage of production, the egg, which may be used in either liquid or powder form is dispersed into the water. This acts as the emulsifying agent.
- Remaining continuous phase ingredients are then added and mixed until dispersed and hydrated.
- The oil is added as rapidly as the continuous phase will take it up. This results in a dramatic rise in product viscosity as the emulsion is formed.

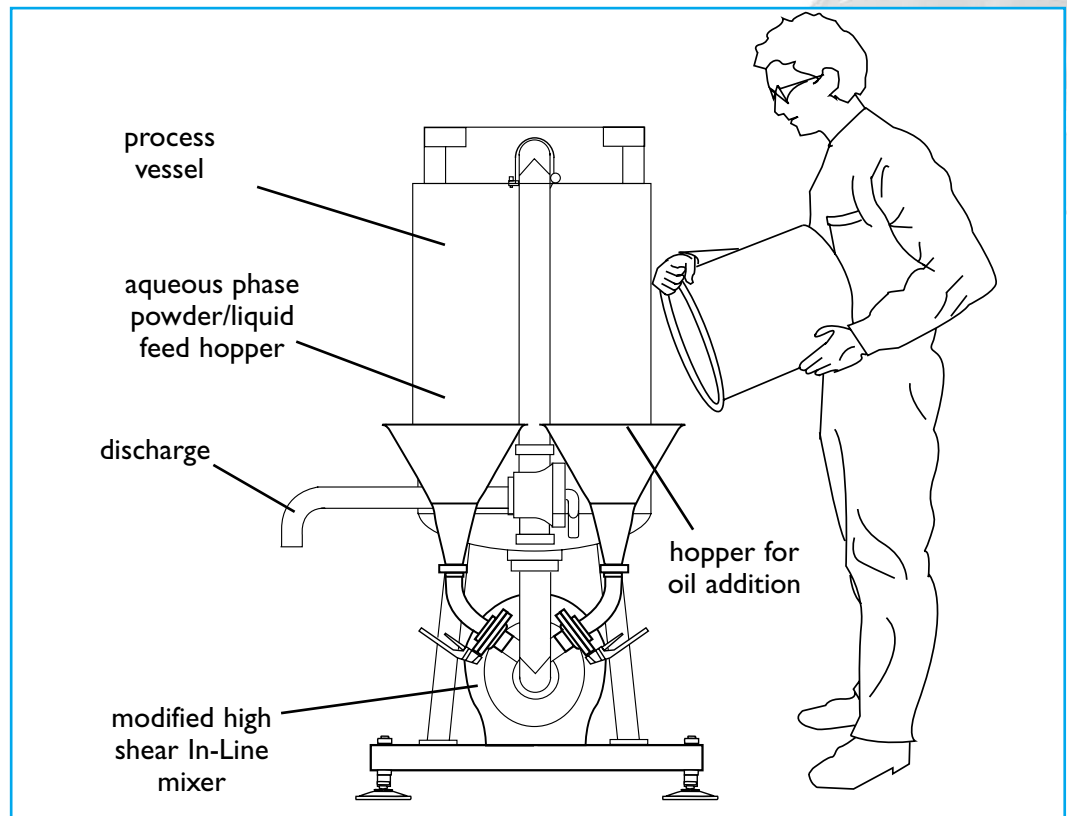
The Problem

The manufacturing process is subject to a number of difficulties, many of which can be exacerbated by operator error:

- Continuous phase ingredients are only a small proportion of the total formulation, but they perform vital functions. The mixing equipment must be capable of dispersing and hydrating these properly in a relatively low liquid volume. If the egg and other emulsifying agents are not properly dispersed and hydrated the emulsion can break during the oil addition stage.
- Hydration of stabilisers and thickeners is one of the most difficult mixing operations. In some cases the solution has to be agitated for a long period to complete hydration. Agglomerates can easily form; these cannot be broken down by agitation alone.
- Due to the high proportion of oil in the recipe the emulsion can break if the oil is not added to the continuous phase correctly. This is very difficult to control when the oil addition is carried out manually.
- Oil phase droplets must be reduced to the smallest size possible to maximise the surface area of oil within the continuous phase to ensure a stable emulsion. This is not readily achieved without specialised equipment.
- Aeration must be minimised or eliminated to ensure maximum product shelf life.

The Solution

Silverson has developed a unit for manufacture of mayonnaise for the ready to use market, R&D and pilot scale production. The unit is capable of carrying out the entire process, including rapid preparation of premixes, hydration of thickening and stabilising agents and preparation of the final oil-in-water emulsion. Operation is as follows:



- Stage 1 Water is recirculated from the vessel through the system by the specially designed In-Line mixer. The egg (either powder or liquid) is added to the vessel and in the case of powder, is rapidly wetted out and dispersed into the high velocity liquid stream.
- Stage 2 The remaining aqueous phase ingredients are then added to the vessel or via the powder feed hopper depending on batch size and powder characteristics. Mixing continues until the ingredients are fully dispersed and hydrated.
- Stage 3 The oil is added to the second hopper. When the valve is opened it is drawn into the aqueous phase at a controlled rate. The aqueous and oil phase ingredients then pass directly into the workhead of the In-Line mixer where they are subjected to intense high shear. This finely disperses the oil into the aqueous phase, immediately forming an emulsion. The vinegar (and lemon juice) is added together with the last of the oil.
- Stage 4 Recirculation of the product continues to ensure a uniform consistency as the viscosity rises. After a short recirculation period the process is completed and the finished product is discharged.

FOOD

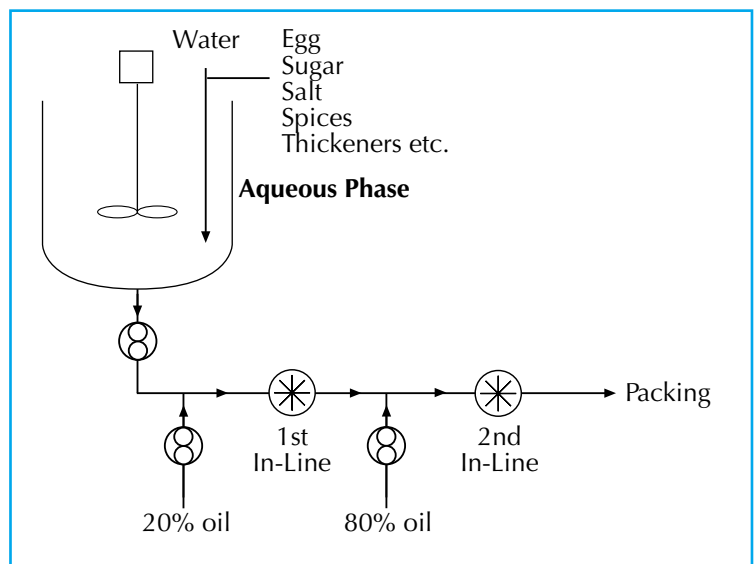
The Advantages

- Ideal for small batches that are intended for immediate use.
- Aeration is minimised.
- The system practically eliminates operator error.
- Offers the batch-to-batch consistency and stability of mayonnaise manufactured in turnkey plant without the high capital expenditure.
- Yield of raw materials is maximised, as thickening agents are fully hydrated and other ingredients are correctly dispersed.
- The system is designed for handling high viscosity products without the need for additional pumps or auxiliary equipment.
- Easily adapted to variations in product type and recipe.

Large Scale Manufacture

Silverson High Shear In-Line mixers can also be used for large scale manufacture of mayonnaise. A typical process would be as follows:

Two In-Line mixers can be used installed in series, the first mixing the aqueous phase with part of the oil. The remainder of the oil is added before the second In-Line. All liquids are fed by metering pumps. High production levels (>5 Tonnes/hour) can easily be achieved.



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