RONO
Food Technology Solutions

PROCESS PAPER

PRODUCTION OF MARGARINE & RELATED SPREADS

INTRODUCTION

Margarine and related spreads always consist of a water phase and a fat phase and can be defined as water-in-oil (W-O) emulsions. W-O emulsions means that the water phase is dispersed as droplets in the continuous fat phase. Thus the fat phase is always fully surrounding the water droplets.
A standard margarine contains a minimum of 80% fat.

Typical ingredients are the various fats, oil components, emulsifiers, beta-carotene, water, salt and flavour. Depending on the type of product and further use, the composition of the fat phase and the water phase is suitable composed and the manufacturing process is chosen accordingly.

GENERAL INFORMATION

Margarine and edible fat products are generally grouped into two fields of application, products for the industrial use and products for the consumer market. Thus we differentiate between.

Industrial margarine & edible fat:
This includes products like bakery fats, puff pastry, shortenings, CBS, ghee or others

Consumer margarine and spreads:
This includes products like table margarine, soft margarine, low fat spreads or butter blends.

The following paper will give a general introduction about the production of margarine and related spreads used for consumer purposes.

THE PRODUCTION PROCESS

The general production process involves different sections like storage, preparation, final production, etc. and can be divided into the following process sections:

- Storage of raw material, tank farm
- Preparation area with water soluble phase and fat soluble phase
- Preparation of the final emulsion
- Pasteurisation
- Cooling and Crystallizing
- Packing section
- Treatment of the Rework

Further functions and production zones to be considered are:

- Automation of the process line
- Cleaning
- Energy supply like the cooling compressor, electrical power, hot water preparation or steam generator

STORAGE OF RAW MATERIAL, TANK FARM

A manufacturing facility for margarine and related products may have its own refinery with various tanks for ready refined fats & oils or can start from a tank farm with different fats & oils, either as fat blend or single oils according to the recipe used for the desired product. The storage tanks are typically placed outside the production facility. It is recommendable to keep a stable storage temperature in the tanks, always above the melting point of the fat and to install a continuous agitation in order to avoid fractionation of the fat and to allow easy handling.

WATER SOLUBLE PHASE / FAT SOLUBLE PHASE

The water soluble phase is normally prepared in the water soluble phase tank and consists of water, salt or brine, milk proteins (for better taste), stabilizers (only for reduced and low fat spreads), preservatives and water-soluble flavours. All ingredients are batch-wise mixed and stored ready to use for the final emulsion preparation.The water should be of good drinking quality. If drinking quality water cannot be guaranteed, the water can be subjected to pre-treatment by means of e.g. a UV or filter system.
The fat/oil soluble phase is typically separate from the fat blend of minor fat-soluble ingredients such as emulsifier, lecithin, colour, flavour and antioxidants. These minor ingredients are batch-mixed and dissolved in the fat blend, ready for use to the final emulsification process.

PREPARATION OF THE FINAL EMULSION

The final emulsion is prepared by first pumping and measuring the various fats and oils or the ready-made fat/oil blend into the emulsion vessel. As a second step the desired quantity of fat/oil soluble phase is added to the fat blend. After all fats & oils and the fat soluble phase have been properly mixed, the water soluble phase is metered into the emulsion vessel. Preferably a two-tank flip-flop system is used. Here each tank works as preparation and/or buffer tank of the final emulsion. Thus the process line will be fed from one tank while a new batch will be prepared in the other and vice versa. Metering of the various fats, oils, water and ingredients as described can be done by a mass-flow meter or alternatively a tank system equipped with weighing load cells can be used. Both systems can be controlled automatically.

PASTEURIZATION

From the buffer tank the total emulsion is continuously pumped through the pasteurization process, which is used to avoid growth of bacterial and other micro-organisms in the final product.

A typical pasteurization profile is to start at about 45–55°C (temperature from emulsion vessel), heating up to 75–85°C (depending on product and further use), a holding sequence of 15–20 seconds before cooling down to a temperature of 45–55°C (depending on the melting point of the fats). Furthermore the pasteurizing and subsequent cooling of the entire emulsion ensures that the emulsion is always entering the following crystallization line at a constant temperature and thus achieving constant processing parameters, product temperatures and product texture.

For the pasteurization of the final emulsion different pasteurizer systems are available and can be used, always depending on the type of product and related recipe.
For most of the full fat products a Plate Heat Exchanger (PHE) can be used as well as a low pressure scraped surface heat exchanger (low pressure SSHE). Both are available in various sizes to match the desired capacity. For several low fat products or products with high protein content and higher viscosity we recommend using the high pressure SSHE RONOTHOR as the most suitable solution.

Example of a RONO low pressure SSHE

COOLING AND CRYSTALLIZING

By means of a RONO high pressure piston pump (HPP) the pasteurized emulsion is pumped through the crystallization line consisting of a high pressure scraped surface heat exchanger RONOTHOR and further crystallisation equipment.

The RONOTHOR is a high efficient SSHE with one or more cooling cylinder in which the emulsion is continuously cooled and efficiently scraped off from the inner surface of the cooling cylinder by means of the scrapers fitted on the rotating shaft. Cooling always takes place by direct evaporation either with ammonia, freon or CO_2 as cooling media. The RONOTHOR is determined in accordance with the desired production capacity, temperature profile, specific recipes and the demands on final product. All this influences the final configuration, technical specification and possible adjustable operation details of the SSHE.
The final kneading and treatment of the products takes place in the RONO Pin Worker Units (PWU), to ensure the proper crystallisation structure and the desired consistency for the end product. The resting tube is the last step in the crystallization process and is only used when products are wrapped in paper.

The crystallization process and all related process parameters have a huge influence on the final margarine and spread products. Therefore it is quite important to identify all characteristics and demands on the products intended to be produced on the RONO line.

Ronothor 2 × Ø 250/1400, 2 × PWU

Pin Worker Unit 2 × 100 litre

Ronothor 1 × Ø 250/2000

PACKING, FILLING AND REWORK SECTION

After the product is cooled and crystallized according to specific product demands it is sent to the packing or filling section. The consistency of the product is very different and needs always to be adapted to the kind of used packing/filling machineries. Products which are packed/paper wrapped must exhibit a firmer texture and consistency than a product which is filled in cups or container.

As so many types of packing/filling machines are available on the market we will not describe further in our process paper. To feed the packing lines and filling machines continually with enough product it is obvious that sufficient product must be available when requested by the packing machines. In the case of product overrun it needs to be melted and sent back to the emulsion vessels for further use. Also when the packing machines stop for a short period or when the final product does not comply with the desired texture and quality, the product will be diverted back to the remelting system for reprocessing.

For this rework purpose different remelt-systems are available. Depending on the product, hourly capacity and further treatment of the product we recommend using either a normal rework tank, a continuousremelt-system like PHE or a low pressure SSHE.

PROCESS CONTROL

The automation of a modern process lines plays a major role in today's food manufacturing operations due to the strict demands for safety and traceability.

The RONO Control System is thus designed for an easy operation to control, record and document all important parameters from the entire process plant.

Only by filing the complete history of all involved process steps, the producer and end user are getting the highest security for later traceability. The most vital data for historic logging are the pump capacity's, motor loads and all product and media temperatures as they provides vital evidence about how the final product was produced.

The control system controls the complete process, starting from the batching of the blends to assure a high and uniform emulsion quality up to further controlling the processing of the emulsion as it turns into the final product.

The RONO control system gives the operator a quick and precise overview of the situation of the process by colour animated mimics showing all relevant process data and due to colour animated process pipes the operator can immediately see the process flow.

The RONO Control System can be operated in either semi-automatic or in fully automatic mode. For trouble shooting purpose the individual components can be operated in manual mode. The Recipe systems ensures that the product is always produced with the right settings.

The recipe and report system is web based and all computers being on the same network as our SCADA server will be able to connect to the recipe and report system. Only an internet browser is needed, like Explorer, Google Chrome or Firefox. No additional software is required to make recipes. All recipes & reports are stored inside a SQL database and reports are kept for one year.

SUMMARY

The given process description can only be a general guideline, as well as the explanation of the various components of process equipment. The final product, recipe, available ingredients, local conditions and specific consumer requirements as well as capital available, will influence the choice of equipment.

You are always welcome to contact us for any further information and any questions you may have, we would be happy to support you in your specific project. Please also visit our Homepage at:
www.ro-no.com

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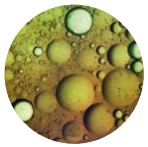
TANK FARM



OIL SOLUBLE PHASE

WATER SOLUBLE PHASE

Oil

Water

SSHE - RONOTHOR

HP PISTON PUMP

SSHE PASTEURIZER (LP)

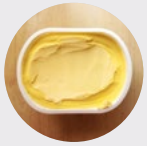
FEED PUMP

EMULSION TANKS

PIN WORKER UNIT (PWU)

REWORK LINE

PHE / STEAM HEATED



Final product - Ready for cartonizer

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