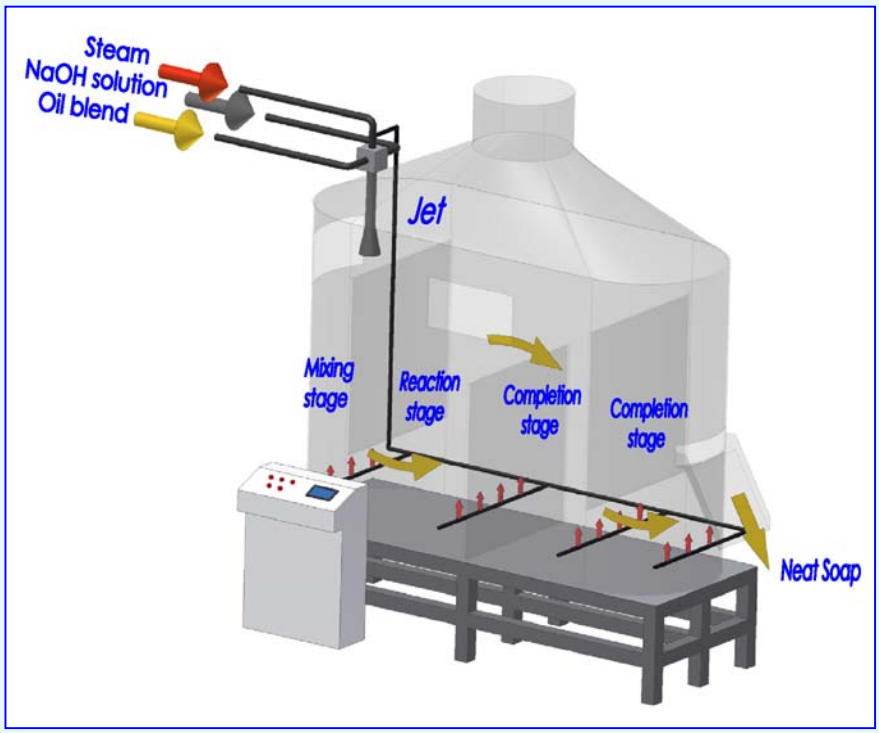
CONTINUOUS "JET" SAPONIFICATION

The saponification process obtained with the JET is extremely efficient and simple and no mechanical actions are needed except pumping the reagents.

The process starts in a Venturi device, the Emulsifying JET, where the oil blend and the alkali meet together with a small flow of steam.

The intimate presence of oil and alkali allows an immediate start of saponification and the formation of a homogeneous emulsion of oil, alkali and soap. This creamy foam falls in a Reactor at atmospheric pressure where the saponification process can be easily completed. A residential time of max 60 minutes is more than enough for a full completion of the saponification process at different conditions. The only aid needed is a minimum flow of live steam.

Features of the design permit minimizing energetic consumption and room requirements, and thanks to its simplicity, it is offered at a very competitive price.



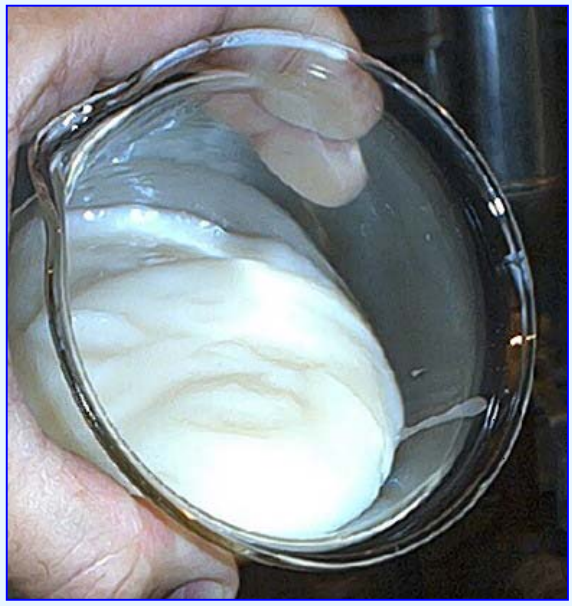
Possible plant combinations are:

- *Full-Boiled Saponification of Neutral Oils/Fats*
- *Semi-Boiled (SWING) Saponification of Neutral Oils/Fats*
- *Semi-Boiled (SWING) Semi-Concentrated Saponification of Neutral Oils/Fats*
- *Semi-Boiled (SWING) Concentrated Saponification of Neutral Oils/Fats*
- *Neutralization of Fatty Acids*

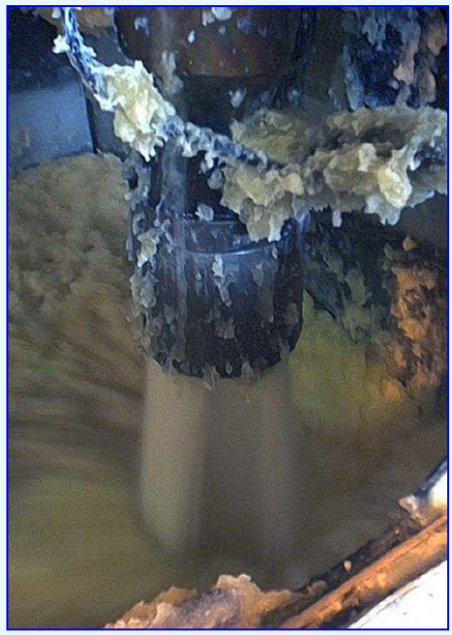
EMULSIFYING JET

The dosing pump (or a dosing group with centrifugal pumps and flow meters) feeds the oils to the JET at a controlled flow and temperature. Same pump delivers the caustic soda solution to the JET in a stoichiometric ratio.
A small flow of steam is the last element passing to the jet.
Steam injection has several functions:

- Provides the necessary kinetic power to generate a great emulsionated interphase.
- Triggers the saponificaton reaction providing the required thermal energy.
- Immediately increases the relative electrolytes percentage so as to allow sudden generation of enough quantity of soap necessary to keep a stable emulsion, whatever the level of free fatty acids might be.



JET in operation in a production plant

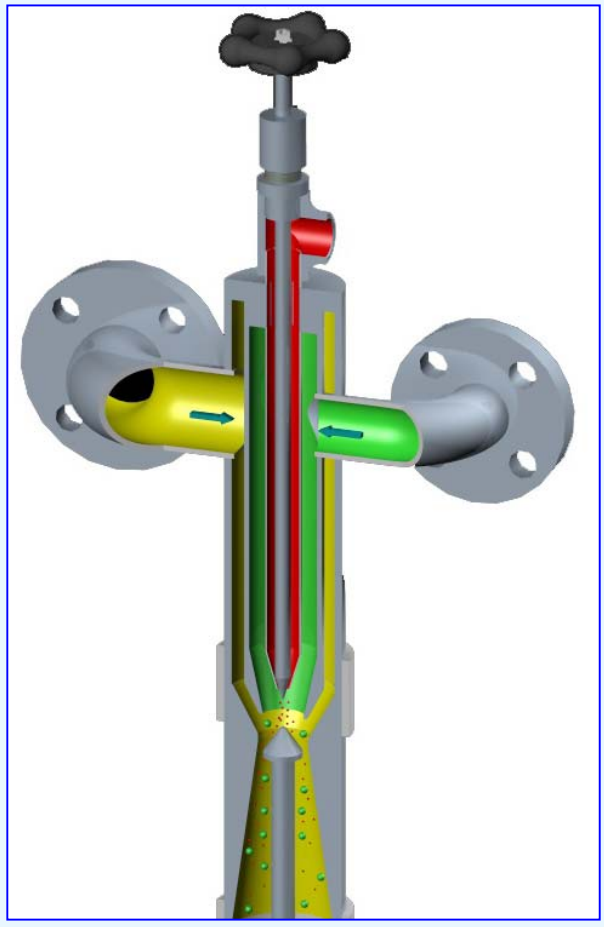


SAPONIFICATION REACTOR

The Reactor is a multi-stage vessel that can be designed in different shapes according to the specific local layout.

It is designed in a way that allows to the reacting mass the residence time of about one hour that is more than enough to assure the complete saponification process.

The emulsion falls from the Jet to the *MIXING STAGE*, from there it flows to the *REACTION STAGES* and finally to the *COMPLETION STAGE*.



MIXING STAGE

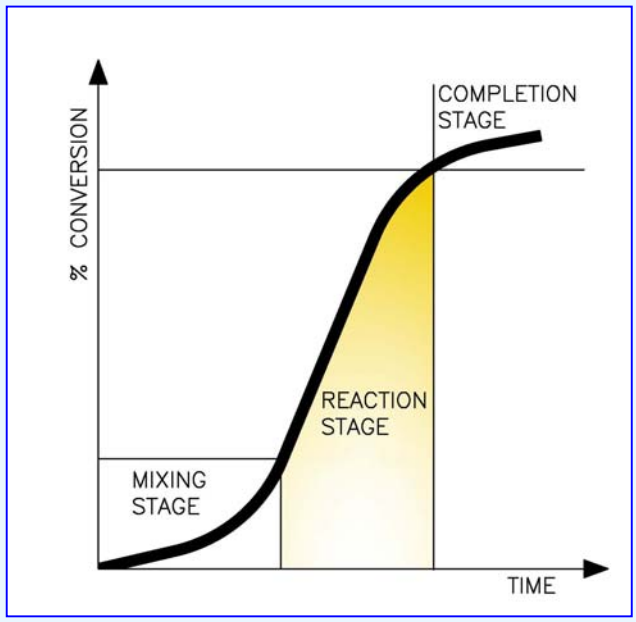
The jet discharges the reacting emulsion into the first compartment. Small flows of live steam keep the emulsion well amalgamated.
In the outlet of the mixing stage the emulsion already contains 35 to 40% of soap.
The reaction is possible at atmospheric pressure thanks of combination of the high degree of JET emulsification and the small quantity of live stream.

REACTION STAGE

In this compartment the reaction is in its linear phase, (see graph). Due to its own exothermia the reaction quickly increases the temperature to that of ebullition, which has a double function:

- Mixes the product without using mechanical devices
- Cools reaction temperature by evaporation. The moisture lost by evaporation is balanced by injection of a small flow of live steam.

The long residence time of the product at this stage (up to 30 min.) assures the completion of the reaction independently on the variation of the nature and specifications of the raw materials. At the outlet, the reacting mass has a value of free oils inferior to 0.1%.



COMPLETION STAGE

The saponification is now completed; due to the low level of residual electrolyte, soap moves here in laminar piston flow for about 20 minutes.
This stage:

- Provides time to eliminate any unsaponified oil
- Provides a visual control point to the operator
- Allows cooling of the soap mass down to an optimal temperature
- Delivers the soap to the down-stream equipment.

SPECIAL FEATURES

- *The JET technology requires a minimum steam consumption* of about 100 kg/h each 1,000 kg/h of produced soap. The steam just helps the generation of the emulsion between reagents then the exothermic saponification reaction develops an optimal temperature without any further steam consumption. The consumption of a JET continuous saponification plant is less than 10% of that of an optimized batch plant.
- Start-up and shut-down operations as well as cleaning and change of raw materials are *quick*, *simple* and require minimum amount of steam.
- *The maintenance is simple and minimum*. The JET has no moving mechanical parts; the pumps are the only moving parts of the process.
- *The process is atmospheric*. The reacting vessel is not pressurized therefore is intrinsecally safe. Pressure seals and joints are not necessary.
- The plant is user-friendly and is easily controlled by a single operator.
- *We design Reactors that are over-dimensioned* for a residential time of 60 minutes while usually the reaction is completed far quicker. This allows great flexibility in the utilization of oils/fats with different features and ... human errors.
- *Easy visual access to all process points*. The operator can see the process through windows. The process tends to auto-adjust therefore the required instrumentation is relatively minimum.

SEMI-BOILED (SWING) SAPONIFICATION PROCESS

The Semi-Boiled process is the saponification without separation of generated glycerol. S.W.IN.G Soap is the acronym of Soap With INside Glycerin. Semi-boiled and SWING are synonymous.

While the Full-Boiled process has been widely preferred in the past now few circumstances made the SWING option economically interesting. These are the reasons that makes the SWING process the preferred route in the majority of the new projects:

1. The comparative cost of glycerin and finished soap, recently does not always justifies the investment for glycerin extraction plant.
2. The availability of food grade impurity-free oils and fats allows the production of a very good quality soap even without the washing stage.
3. SWING soap contains the generated glycerin which is an appreciated emollient for the skin.
4. Semi-boiled plants do not generate sweet-waters nor any by-product to be disposed.
5. Last but not least … the SWING plants are simpler and smaller. The capital expenditure and the utility consumption are reduced.

SEMI-CONCENTRATED AND CONCENTRATED SOAPS

In the Full-Boiled process water with electrolytes is abundantly used for washing the (curd) soap. In the Continuous process a Centrifuge is used to separate the excess of electrolytes from soap and final result is a moisture level of about 32% (equivalent to Total Fatty Matter of 62%).

In the SWING process, with conventional plants, the water content is kept on the high side in order to facilitate the saponification reaction and final result is usually a moisture of about 30% (TFM about 58%).

In both cases, after the saponification is necessary a Drying stage in order to reduce the moisture level down to about 12% (toilet soaps) or about 20% (laundry soaps). When drying, the soap is also cooled down to about 25-30°C.

The Drying Plants are powerful tools but are expensive and consume a lot of utilities (energy).

The combination of the SWING process and the JET technology brings to a novel and smart approach for the production of the Soap Noodles.

Thanks to the formation of a *homogeneous emulsion* between reagents, obtained by the unique action of the JET, the saponification process can be successfully and homogeneously obtained regardless the concentration of the caustic soda solution therefore the produced soap can be *"semi-concentrated"* (moisture at 20-24%) or *"concentrated"* (moisture at 12%).

A "semi-concentrated" soap can be processed in a Drying Plant with reduced utility consumption (small Heat-Exchanger, small Atomizer, reduced Vacuum Group).

A "concentrated" soap can be cooled in Chill Rolls (Double Drum Flakers) that do not consume steam and only need chilled water.

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