COEI-1-NANMEM Nanofiltration membranes

1. Object, origin and scope of application

Membranes belonging to the family of semi-permeable membranes, these can be homogenous or composite membranes and are generally organic; they may have a spiralled or "spiral-wound", flat sheet or "frame and plate", tubular or hollow fibre configuration.

Nanofiltration is a membrane technique under pressure that covers a separation scope between reverse osmosis and ultrafiltration, enabling the separation of molecules in solution at less than approximately 2 nm. Most of the membrane materials used in nanofiltration have surface charges that play a part in the separation of ionic species, thus the selective retention of multivalent ions compared with monovalent ions can be obtained.

Generally, the MWCO (Molecular Weight Cut Off) of separation for organic compounds varies from 150 to 500 $g \cdot mol^{-1}$ (150 to 500 daltons) to a maximum of 2000 $g \cdot mol^{-1}$ (2000 daltons).

The transfer selectivity of the solutes through the membrane is generally expressed by their retention rate (= [1- (final conc. / initial conc.)] x 100).

2. Procedure principle

This is a physical method of removing a portion of the solvents (water and alcohol) and very low molecular weight compounds from the must or wine (close to the cut off) using a semi-permeable membrane driven by a pressure gradient at ambient temperature and without changing or altering its state.

The process is carried out as a tangential flow.

The apparatus may consist, for example, of a high pressure pump (e.g. from 2 to $8 \cdot 10^4$ Pa or 20 to 80 bars) used to overcome the osmotic pressure, a membrane block and monitoring equipment, such as a flowmeter, pressure indicator and controller, etc.

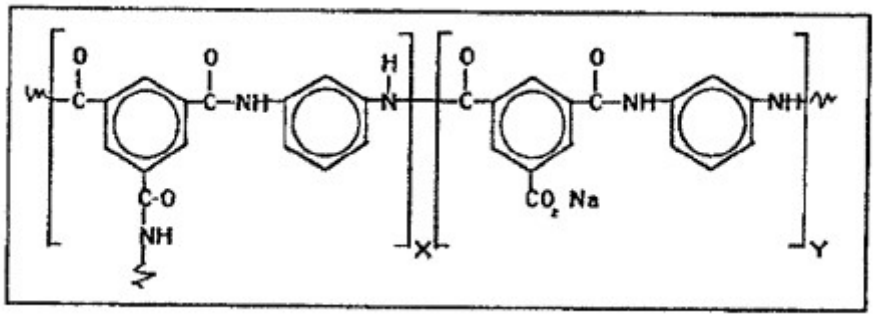
3. Composition

All the equipment used in the procedure conforms with regulations relating to equipment in contact with food (pipes, pumps, monitoring equipment, joints, etc.).

These membranes are usually prepared through *in situ* polymerisation of a polymer on the surface of a porous substrate. The thin layer serves as the discriminating membrane, while the porous substrate acts as the physical support.

For example, the main organic polymers used may include cellulose acetate and polyamide, etc.

As an example, the structural formula of the polyamide base is as follows:



4. Labelling

The main characteristics should be indicated on the label, particularly the batch number.

5. Manufacture

Through a number of procedures, it is possible to obtain a whole range of pore sizes, from tangential microfiltration to the dense membrane of reverse osmosis.

The final characteristics (thickness, porosity, pore size, internal structure) of the membrane depend on a great number of parameters (choice of ternary solvent/polymer/non-solvent, composition of collodion, addition of porogenes, operating conditions - temperature, casting speed, diameter/thickness of the collodion, etc.)

6. Membrane cleaning

The user may use inorganic products authorised according to regulations, provided that the operation ends by rinsing with water so as to completely remove the cleaning product before adding the must or wine.

7. Limits

All the equipment in contact with food products must comply with the standards in force.

There should be no noticeable change in the organoleptic characteristics of the processed must or wine.

Any potential release of the product or derivative comprising the membrane must comply with the current specific migration standards for the various constituents of the equipment.

8. Special restrictions

The membrane must meet the regulatory requirements for equipment in contact with food.