

FRUIT JUICE FILTRATION / HOBRA ADVISES

The fruit juice/concentrate manufacturing process is a complex chain of operations that resembles other food/beverage industry processes but in some aspects is quite specific. Like in all branches of the food industry, this process uses natural raw materials and the product is subject to the most stringent requirements of applicable standards. Taste and flavour, color, resp. appearance, or for example storage life, are some of the most important qualitative parameters.



Manufacturing process and the Alicyclobacillus bacteria issue

Product contamination with thermally resistant microorganisms, such as some bacterial strains of the Alicyclobacillus genus, presents probably the most serious problem in the whole fruit juice manufacturing process. Above all the high temperature resistance of their spores is a major issue. Common pasteurization does not kill the spores: in fact, this process activates them, thus inducing their germination. As a result, the bacteria propagate and spoil the product. The above microorganism species can get into the product not only from the primary manufacturing process but also from auxiliary sources such as process water. AIJN – European Fruit Juice Association has issued a document identifying the critical points in the fruit juice manufacturing chain. Alicyclobacillus acidoterrestris – a strain of acidophilic, thermophilic and spore-forming bacteria – is the main representative of the microorganisms discussed above. The spores of the bacteria are typically 0.9 – 1 µm long and 1.5 – 1.8 µm wide.

Efficient and reliable filtration

Filtration is a key process in the manufacture of the product – fruit juice or concentrate. The size of the A. acidoterrestris spores allows filtersheets to be used to remove the spores. Filtersheet efficiency in removing microorganisms has been verified not only within a number of publicly available studies but, primarily, by the rich experience accumulated by company Hobra – Školník s.r.o., during its many years of operation in the fruit juice filtering business. Hobrafilt® depth filtersheets have been in use within this industry for many years, and their quality is being confirmed by customer satisfaction.

The filtersheets owe their superb performance to their unique structure. The separation process uses a combination of 3 contaminant capture mechanisms – sieve (surface) filtration, mechanical and electrostatic depth filtration, and electrokinetic adsorption. The major parameters in the filtering process include, in particular, the filtersheet type, filtration rate, and the maximum pressure difference. All of the three parameters can affect the filtration result quite substantially.

The filtersheet type is defined, among other things, by its nominal retention value (in microns), which is a parameter representing the pore size distribution in the sheet. This parameter gives us an idea of how efficient the sheet will be in reducing the bacteria (spore) counts. The Logarithmic Reduction Value (LRV) defines the sheet's reduction potential as the logarithm of the bacteria (spore) concentration ratio before and after the filtration. The filtration efficiency is also affected by the filtration rate. Experience has confirmed the hypothesis that the slower the filtration process, the more spores will be captured and hence, the higher spore reduction degree will be attained. The maximum pressure difference also has a major effect. This is basically in line with existing experience in the filtration of other beverages. Filtering efficiency deteriorates as the pressure difference is increased.

Additional microorganism count reduction can be achieved by implementing membrane cartridges in the system taking into account the specific product properties (e.g. pulp/no pulp). Experience has shown that membrane filtration is the most efficient way of reducing the A. acidoterrestris spore counts. This filtration step is applied immediately before bottling, thereby minimizing the secondary contamination hazard. Also, the cartridges can be well tested for integrity.

An overview of suitable filter sheets and membrane cartridges and their specifications, completed with recommendations to attain the best filtering results and efficiency, is presented below.

HOBRAFILT® depth filtersheets “N” series: overview of types appropriate for filtering fruit juices and concentrates:

Filtersheet grade	Nominal retention rate (µm)	Water flow rate (L/m ² /min [®] 100 kPa)	Thickness (mm)	LRV*	Recommended flow rate (L/m ² /hr)	Recommended maximum pressure difference (bar)
ST 3 N	0,2	25 – 38	3,8	8	150 – 300	1,5
ST 5 N	0,3	44 - 67	3,8	7	150 – 300	1,5
ST 7 N	0,4	79 – 109	3,8	6	150 – 500	1,5
ST 9 N	0,6	100 – 130	3,8	6	150 – 500	1,5
S 10 N	0,8	127 - 174	3,6	-	300 – 700	2
S 11 N	0,8	117 - 144	3,8	-	300 – 700	2
S 16 N	2	204 - 252	3,8	-	300 – 700	2

* Based on an internal SOP

CANDEFILT® membrane cartridges: overview of types appropriate for filtering fruit juices and concentrates

Cartridge grade	Absolute retention rate (µm)	Water flow rate (L/h @ Δp = 0.1 bar)	Length (inch)
HMVX 02 BS 30 S	0,20	3600	30
HMVX 04 BS 30 S	0,45	4500	30

