Vacuum Salt

definition and scope for organic vacuum salt

1. Definition

In Europe, many salt deposits were formed over 200 to 250 million years ago as a result of the evaporation of ancient seas. The depth of a salt deposit can vary from 100 metres to 1.5 kilometres. These salt deposits are available across Europe and known reserves have provided salt resources for well over 1000 years. This natural resource is free of anthropogenic contamination, such as microplastics and/or heavy metals.

Vacuum salt can be extracted from these salt deposits by using solution mining. Solution mining is the practice of using local spring or surface water to dissolve ancient salt deposits, resulting in the formation of caverns. Solution mining is an intrinsically safe mining method and current practice ensures cavern stability during operation and after abandonment. Alternative routes to vacuum salt are natural brines or the dissolution of rock salt.

The brine obtained from the dissolution of salt deposits is transported via pipeline to a vacuum salt production facility.

Although vacuum salt production requires energy inputs, it also enables local salt production in areas where, for example, extensive areas such as evaporation ponds are not available and/or climatic conditions do not allow for crystallization. During evaporation, clean water is recovered which can subsequently be reused in the solution mining process, ensuring a minimal use of natural resources.

For vacuum salt, two technologies may be employed:

- The 'Multi-Effect Evaporation', (MEE) which has a heat-driven technology;
- The 'Mechanical Vapour Recompression' (MVR) which is electricity-driven.

A company's choice between these two technologies (electricity driven or direct heat) tends to be a historical and economical choice. Various factors are considered, such as available energy mix, geography, proximity to end-user, etc. With a Mechanical Vapour Recompression (MVR), the plant can be run very economically, if electric power is available from the grid system of the plant, or the same is attainable at a low price from the electric supply line. By using electric energy, the vapours from the evaporator are compressed to a high pressure, thus leading to rising temperatures, which are reused as heating medium for the heat exchanger.

Whereas a Multi-Effect Evaporation (MEE) uses multiple effect evaporators, typically 3 to 5 evaporators in series. Each evaporator operates at a lower pressure than the previous with the final evaporator effect operating at near vacuum. The reduced pressure allows the brine to boil at a lower temperature, which takes less heat energy to achieve the boiling point, improving energy efficiency. With MEEs, evaporated water from the previous effect can be used as a heating medium for the upcoming effect. As a result, the overall consumption of energy can be significantly reduced; however, investment costs increase when evaporation effects are added. In other words, some installations using MEE technology use heat produced by integrated

Combined Heat and Power (CHP) plants within the local industrial agglomeration. CHP installations provide the essential heat used to fuel the evaporation process of salt, while producing electricity used on-site.

The decision to use MEE or MVR technology was originally a geographic and economic decision. Therefore, it is difficult to claim that switching from MEE to MVR is the best solution in terms of emissions and profit. Although, MVR technology can be considered as the best available technology (BAT), it is not economically viable and environmentally efficient to drastically change from an installation using MEE technology with steam obtained from a boiler running on natural gas or biomass.

European vacuum salt producers have made many changes to reduce their product footprint and their environmental impact. Producers follow certain certification schemes (e.g. ISO 14001/EMAS, ISO 50001, etc.), which show and document this commitment. These certification schemes have clear strategic aims to continuously increase energy efficiency or reducing energy consumption (same for other resources or waste management). Another aspect is the use of renewable energy (electric power from photovoltaic, hydro, wind or heat from biomass).

Another logical consequence of vacuum salt production and the focus on the minimization of energy consumption is the need for brine purification. Brine purification is the upstream process for removal of scaling compounds (mainly calcium salts) that would otherwise increase energy consumption in the evaporation section. Main technique is contacting brine with soda ash or similar compounds to increase pH, allowing for calcium carbonate to precipitate out of the salt brine solution and providing the opportunity for removal. Additional benefit of the reduced scaling tendency by brine purification is also a higher purity of the product salt as components other than sodium chloride are removed. Recovered material from brine purification can be used in organic farming (Ecocert Organic Standard V05) for soil improvement.

Most energy efficient is to remove excess mother liquor/moisture by centrifugation after the evaporative crystallization process, followed by drying. In order to achieve energy efficiency this is carried out in closed and controlled environments.

2. Compliance with Regulation 889/2008

The organic vacuum salt process complies with the following objectives according to article 4 of Regulation 889/2008:

Contributing to protection of the environment and the climate:

- Low energy consumption => low CO_{2eq}-emissions, primarily by making use of highly energy efficient salt production processes and low CO_2-footprint energy sources,
- Above ground only small areas are needed to process the raw material,
- Local production ensures less transportation costs and encourages short distribution channels.

Substantially contributing to a non-toxic environment:

- Use of processing aids is highly regulated by food and feed production standards,
- Organic vacuum salt has a high purity originating from the ancient salt deposits that were formed in times without any human activity and potential for pollution.

Encouraging short distribution channels and local production in the various areas of the Union:

- As vacuum salt can be produced in various areas throughout the whole Union short distribution channels can be guaranteed. Transportation of salt products has a higher environmental impact than the salt production itself. Short distribution channels support the protection of the environment.
- All other aspects of article 4 are not relevant for vacuum salt production as they deal with animal welfare and biodiversity.

Additionally, the vacuum salt process complies with the following general principles according to article 5 of Regulation 889/2008:

The preservation of natural landscape elements, such as natural heritage sites:

- As only small areas above ground are needed there is no influence on natural landscapes => the preservation of natural landscapes and heritage sites can be guaranteed.

The responsible use of energy and natural resources, such as water, soil, organic matter and air:

- Natural resources such as salt deposits are abundantly available, spring and surface water intake can be minimized by reusing the water obtained in evaporation. The vacuum salt process intrinsically minimizes energy input by the use of vacuum (enabling lower boiling and evaporation temperatures) or heat pump technology (MVR).

The production of a wide variety of high-quality food and other agricultural and aquaculture products that respond to consumers' demand for goods that are produced by the use of processes that do not harm the environment, human health, plant health or animal health and welfare:

- Vacuum salt is the product from salt deposits formed 200 to 250 million years ago. The food products fulfill the highest demands of the customer. In addition, salt is a crucial part of animal feed.
- Many salt products have a high domestic rootage and link to the production area.

Ensuring the integrity of organic production at all stages of the production, processing and distribution of food and feed.

All other aspects of article 5 are not relevant for vacuum salt production as they are related to live-stock production and organic agriculture.

Processing aids and conditions for their use in organic salt are not included in Reg. (EC) 848/2018, because they are not considered food ingredients (see definition of "Processing aid" in Reg. (EC) 1333/2008). Regulation (EC) No 889/2008 on organic food mentions a list of allowed processing aids for organic food production (Annex VIII, section B).

At present there is no EU legislation governing processing aids in food (except for solvents and enzymes) but national legislation may exist which authorises their use and establishes positive lists of processing aids which can be used in industrial processes for specific products. If there is no national regulation governing the processing of a particular food this does not prevent the use of processing aids, provided that the producer can guarantee that the processing aid is not consumed as a food ingredient by itself, or intentionally used in the processing of food to fulfil a technological purpose during treatment or processing, which may result in the unintentional but technologically unavoidable presence of residues of the substance or its derivatives in the final product, provided that these residues do not have an adverse effect on human health or the environment and do not have any technological effects on the finished food (i.e. in accordance with the definition of "processing aids"). This also means that there is no list with legislatively established limits for processing aids for food. This does not necessarily mean that allowed processing aids for food salt production are fit for organic salt production.

For organic vacuum salt, processing aids are either defined as per Annex VIII of Regulation (EC) No 889/2008 or allowed when their technological purpose is aimed at other parts and materials than the sodium chloride constituting the food salt.

For example, use of sodium carbonate (soda ash) and sodium hydroxide (caustic) are allowed in organic salt production as they are defined as per Annex VIII of Regulation (EC) No 889/2008. In addition, they are also allowed as their technological purpose is to be converted into precipitate that is removed from the salt brine (these compounds are not acting on the sodium chloride itself).

The use of processing aids not defined as per Annex VIII of Regulation (EC) No 889/2008 is only allowed for organic vacuum salt provided that the processing aid does not influence sodium chloride ions present in the brine used for making organic vacuum salt.

3. Suggested list for permitted organic vacuum salt processes

Finally, for the purpose of the Delegated Act for organic salt, we suggest the following vacuum salt processes be permitted from the regulation:

The use of the following practices, processes and treatments is permitted following an implemented sustainable management approach:

(a) Direct supply of salt spring water or salt lake water for salt obtained from natural brine;

(b) Use of water or non-saturated brine to dissolve rock salt (solution mining);

(c) Use of natural brine and/or rock salt as starting material

(d) Use of technologies of vacuum processes (MEE) or heat pump processes (MVR) applying best available techniques including brine purification, evaporation/ crystallization, centrifugation, and drying