Dairy Industry Salts

IDF Factsheet – February 2012

How to Reduce the Impact of Salts from the Dairy Industry on the Environment

Excessive salts, especially sodium, can have an adverse effect on the environment. If the proportion of sodium to other cations is high when dairy plant wastewater is applied to land, the soil structure risks deterioration. If so, the soil can no longer treat the applied wastewater and becomes water logged.

The quantity of salts contained in dairy plant wastewater and applied to land must also be restricted to prevent adverse effects on groundwater.

The methods described below aim at reducing the quantity of sodium in the wastewater.

Step 1 - Change Cleaning Agents

Replace CIP cleaners with reduced or no sodium formulations. This is mainly achieved by using potassium of calcium salts to replace the sodium.

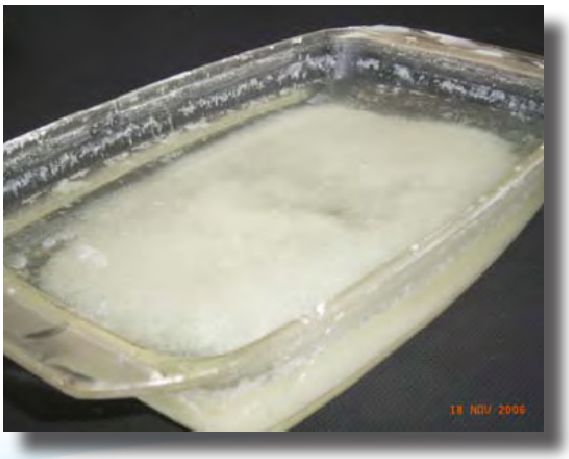
Step 2 - Chemical Recovery Systems

The simplest chemical recovery system consists in tanks in which the used chemical --usually caustic or nitric acid-- remains for about 10 to 20 hours. The waste solids settle to the bottom of the tank and are removed. Microfiltration membranes are used to clarify spent caustic solutions by rejecting waste solids and clarifying remaining caustic for re-use in CIP systems. This results in extending the re-use life in reclaim chemical clean-in-place (CIP) systems. Chemical re-use can be further enhanced by immediately following with a Nanofiltration (NF) step to remove dissolved soils from the cleaning solution.

Step 3 - Reverse Osmosis of Brine Solutions - Reuse Recovered Salts (Permeate)

Salt brine is used to cure many different varities of cheese. Disposal of salt brine is expensive and often prohibitive. Ultrafiltration rejects the fats and protein that are expelled from the cheese into the brine and allows continuous reuse of brine baths.

98-99% purity mirabilite produced by refrigeration



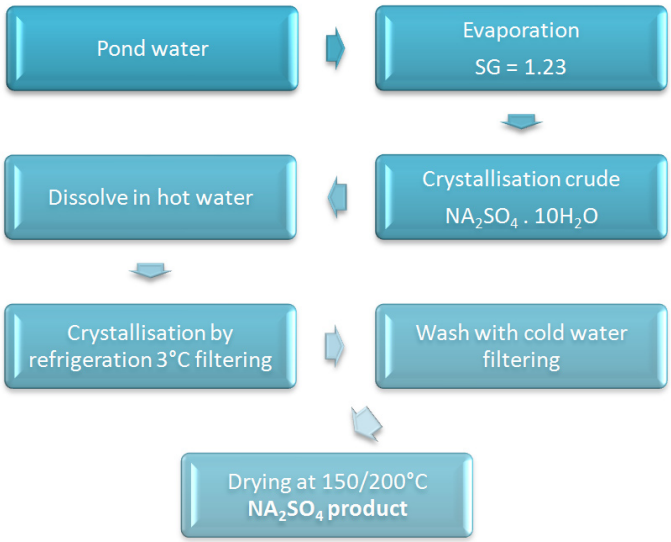
90-95% pure (raw) mirabilite produced by evaporation

Step 4 - Segregate High Salt Streams & Recover Salts

Segregation of the streams with a high salt concentration reduces the volume of problematic wastewater that requires treatment. Hence streams such as salt whey, Ion exchange regeneration solutions and AMF salt serum can be diverted from the main wastewater stream and treated separately. Salt streams can be treated biologically and evaporation ponds used to further concentrate the salts. A Dairy Australia study showed the following salts could be recovered from dairy plant wastewater:

- Sodium sulphate hydrate (mirabilite, Na2SO4.10H2O)
- Sodium chloride- potassium chloride (NaCl/KCl)
- Calcium hydrogen phosphate (brushite, CaHPO4.2H2O)

Problems occur with this process when different acids are used in the same process generating sulphate and chloride salts in the same evaporation pond. Unfortunately the cost of the raw salts such as Na2SO4 is significantly less than recovering them from dairy plant wastewater.



Conversion to High Value Products

In theory, recovered salts could be converted into higher value products. However, economics again restrict this developmen. Possible products and processes are:

- Potassium chloride to potassium sulphate --> Using sulphuric acid
- Sodium sulphate to sodium hydroxide and sulphuric acid --> By electrolysis
- Sodium chloride to sodium hypochlorite --> By electrochemical cell

Conclusion

It is possible to reduce the quantity of salts, in particular sodium, in dairy plant wastewater. The most common method is chemical recovery, either with tanks or membrane systems. The other methods are generally uneconomical at present.

International Dairy Federation
www.fil-idf.org

References
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