Salts & the Environment

IDF Factsheet – February 2012

Salts *K*, *Na* and *Ca* occur either in milk from farms or in the chemicals used to clean the manufacturing plants. These salts end up in wastewater which is then discharged into the environment.

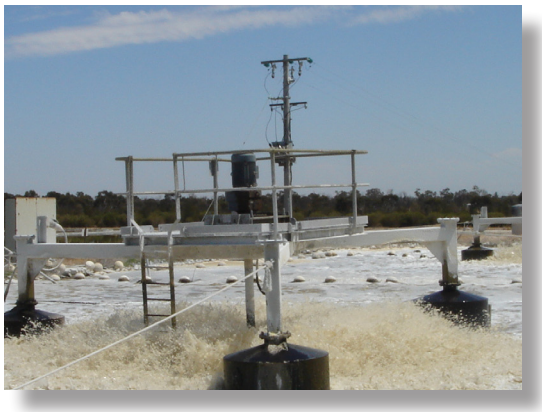
This factsheet describes the sources of salts in the dairy industry and their effects on the environment.

When the concentration of salts, particularly sodium, gets too high in soils, the soil structure can collapse, meaning the infiltration rate of the soil decreases. This causes ponding and overland flow of applied liquids. Increasing salt concentrations in groundwater results in a more corrosive water source which limits the uses for groundwater.

Sources of Salts from Dairy Plants

The table details the composition of the wholemilk and the resultant whey and process wastewater streams. The salt whey has greatly increased *Na* and *Cl* concentrations while in the process wastewater the ratio of *Na* to other cations is greatly increased when compared with wholemilk. This is due to the quantity of caustic solution used in the manufacturing plant to clean the processing equipment

	Whole milk	Whey	Salt whey	Process wastewater
Ash (g/m^3)	7200	5100	43000	1760
Sodium (g/m^3)	414	440	21000	543
Potassium (g/m^3)	1410	1560	1770	105
Calcium (g/m^3)	1485	610	2450	80
Magnesium (g/m^3)	100	77.5	160	12
Chloride (g/m^3)	1020	1065	20280	114
Nitrate-N (g/m^3)	0.18	0.18	-	8
Phosphorus (g/m^3)	678	367	640	94
Electrical conductivity (µS/cm)	5000	5100	43000	2450

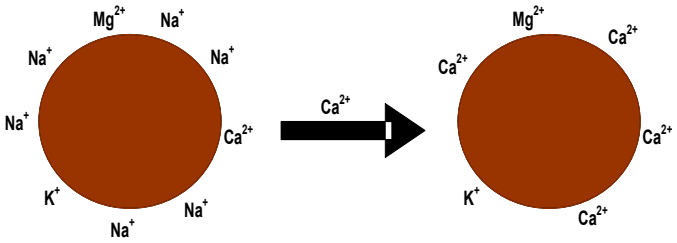


Wastewater Disposal

Wastewater from dairy manufacturing plants is usually treated biologically i.e. in an aerobic or anaerobic/aerobic system and then discharged to land or into a waterway. When the wastewater is discharged onto a soil, it is important that the soil structure be maintained so the soil continues to treat the applied wastewater.

Effects of Salts on Soils

Sodium deflocculates soils; this reduces the infiltration of water and wastewater into the soil. To overcome this it is necessary to keep Sodium Absorption Ratio (SAR) of wastewater under 10 and keep Exchangeable Sodium Percentage (ESP) of soils under 5. The SAR of dairy plant wastewater varies depending on the product manufactured. Milk powder plants will have SAR.10 while Cheese plants will have SAR under 10. The ESP of most arable soils is under 2.



This is best achieved by adding Calcium (usually as lime) to the wastewater or soil. When lime is added to soils the *Ca* ions replace the *Na* ions which are then flushed from the soil to the groundwater. It is important that the applied wastewater does not exceed the standards detailed in the tables otherwise the use of the groundwater can be restricted.

Effects on Groundwater

Salts increase conductivity and corrosiveness of groundwater.

Human Drinking Water Standards

	WHO (2006)	New Zealand	Reason
Chloride	250 mg/L		Taste
Hardness	200 mg/L 500 mg/L	200 mg/L 100-300 mg/L	Scale Taste / Household use
Sodium	200 mg/L	200 mg/L	Taste
Total dissolved solids	1000 mg/L	1000 mg/L	Taste

Stock Drinking Water Standards

	Limit ANZECC (2000)	Notes
Calcium	1000 mg/L	
Magnesium	-	Not known at this time
Sulphate	1000 mg/L	Adverse effects at 1000-2000 mg/L Acute health problems >2000 mg/L
Total dissolved solids -dairy	2400 mg/L	

Conclusion

Wastewater from dairy manufacturing plants contains considerable quantities of salts and in milkpowder plants, salts are dominated by the percentage of sodium. Care must be taken when applying dairy plant wastewater to soils as excess sodium can lead to a deterioration of the soil structure and therfore, the soil can no longer treat the applied wastewater. The problem can be mitigated by the addition of Calcium salts either to the wastewater or soil. Attention must be given to the total quantity of salts applied to the soil so that the use of the groundwater below the wastewater application area does not become unsuitable for its intended use.

International Dairy Federation
www.fil-idf.org

References

Design of Land Treatment Systems for Industrial Wastes-Theory and Practice
Overcash and Arbor, Science Publications pg 335-348 (1981)