

MANDERSTAM'S EXPERIENCE IN SALT-BASED INDUSTRIES

LIST OF RECENT SALT PROJECTS

| <u>PROJECT</u> | <u>CLIENT</u> |
|--|----------------------------|
| Salt Production - Oman | Government |
| Salt Production/Salt Based Industries – North Yemen | UNIDO |
| Development of Salt Based Industries - Mahgreb | UNIDO |
| Solar Salt Production – St Kitts | Caribbean Development Bank |
| Development of Expansion of Salt Plant - Oman | Omninvest |
| Egyptian Salt and Soda Co Ltd - Egypt | Government |
| Establishment of Caustic Soda and Chlorine | Iran Government |
| Recovery of Potash and Allied Products from Dead Sea | Jordan - private |

SALT PRODUCTS

Edible Salt

Salt is an essential constituent of the human diet. It can be ingested by eating meat and fish or by salt flavouring on vegetable foodstuffs. The normal urban per capita consumption is around 10 kilograms per annum whereas nomadic populations living on meat and fish may not use any salt at all. In Oman, overall, the consumption per head per annum could be lower than 5 kilograms thought, whatever the present figure, consumption is likely to rise as a consequence of current social changes.

Edible salt does not need to be 100% sodium chloride: indeed, the normal impurities of sea salt (calcium sulphate, magnesium sulphate and magnesium chloride) may be beneficial and often are claimed to enhance the salty taste. However, such soluble impurities are rarely present in sufficient quantities to be recognised by taste. By contrast, insoluble impurities (dirt), which adhere to salt crystals in production, transport and packaging, do need to be removed.

In general the physical texture and appearance of table salt are important for customer acceptance. Although a wide range of crystal sizes are saleable, each speciality needs to be provided with relatively uniformly sized particles. Most table salts also require a free-running agent (usually trace quantities of magnesium carbonate) to prevent caking in salt containers.

Potassium iodide is added to table salt in localities where the soil and local foodstuffs are deficient in iodine. Further investigation would be required to establish whether this is relevant for Omani conditions or whether other medicinal additives should be considered.

Foodstuffs Preservatives

The widespread use of salt for flavouring sometimes obscures the fact that it is most important as an antiseptic and preservative. It is added to butter, cheese, cabbage, cauliflower, onions, cucumber, green tomatoes, meat, fish and bread to control the microbial population in these foodstuffs. Since, according to the present five-year plan Oman is to develop a home-produced foodstuffs industry, this will create additional demand for salt.

However, the technique of salting is being replaced by refrigerated strata in many countries, primarily because of the improved taste of the end product. Nevertheless, in a highly developed country such as the USA, the salt requirements for the domestic foodstuffs industry is equivalent to another 5 kilograms per head per annum. This figures includes, besides the basic items listed in the previous paragraph, salt for canning, baking, fish and meat packing, curing and tanning of hides and skins.

Industrial Application

Salt may be used, as salt, for a large number of industrial applications which may have relevance in Oman: for example, water softening (zeolite regeneration), road

construction (soil stabilisation), oil well drilling (for drilling mud) and refrigeration. Other applications in industrialised countries of temperate climate, for example ice removal from roads, tile and pottery glazing and textiles conditioning, may be ignored in the context of the domestic market in Oman. In general, neither the chemical purity nor the physical texture of salt for these applications is a critical factor: price is.

Chemical Derivatives

On a world scale, the main use for salt is as a feedstock for chlorine and sodium chemicals (the chloralkali industry). An illustration of the major chemical derivatives appears as Fig 1. In advanced industrialised countries these uses may amount to 60 – 90% of the total salt demand. The leading chlorine derivative is the popular plastic, polyvinyl chloride (PVC), usually manufactured from ethylene and chlorine. Next in importance is hydrochloric acid, used in metal processing (commonly steel), oil well acidizing and starch hydrolysis. Chlorine itself is used for water purification, textile bleaching and pulp and paper manufacture. Chlorinated solvents (for example, ethylene dichloride, trichloroethane, and carbon tetrachloride) are used for various cleaning applications. Chlorinated hydrocarbons (for example, DDT, BHC and its Lindane isomer) are insecticides. A complete list of chlorine derivatives produced would number over a hundred and include, besides those noted above, neoprene rubber, chloroform, chloramphenicol, chloro-xyleneol (Dettol), TCP, trichloroethylene (an analgesic), hyoscine, atrophine, cocaine, procaine, morphine, quinine, paludrine and vitamin B.

The sodium derivatives are even more numerous and include sodium hydroxide (caustic soda in the main constituent in Kleenoff), sodium carbonate (soda ash or washing soda) and sodium bicarbonate (baking powder). Soda ash itself has an enormous range of uses – toothpaste, salt cake, putty, cosmetics, china, clay products, ceramic flux, gas purification, glass, wood pulp, cleaning compounds, water softening. Caustic soda is a major component in the industrial manufacture of soaps, rayon, soda ash and many other sodium salts.