Experimental Salt Farm: III—Hardening Crystallizer Bed with Manganese Sulphate

G C JAIN
CSMCRI, Bhavnagar

Advantage is taken of the hardness of salt crystals obtained by addition of traces of manganese sulphate to saturated brine, in preparing hard crystallizer beds.

Presence of trace of manganese sulphate in saturated brine causes change in crystal habit and formation of hard salt crystals. Experiments have been carried out at the salt farm of the Institute with a view to stabilize the crystallizer pan beds and make them hard taking advantage of this property of manganese sulphate.

Method

Saturated brine is let in to the extent of 3 cm. into the crystallizer bed (12.5 x 6.25 metres) prepared in the conventional way. The pan bed is not allowed to dry before letting in brine as otherwise deep cracks are formed in the pan. Desired quantity of manganese sulphate is added, in the form of solution so that it may get evenly distributed. The brine is permitted to concentrate till it attains a specific gravity of 1.257. The small grains of salt crystals formed are tampered in the conventional way and finally rolled to obtain smooth surface. The brine is again let in to the depth of 12.50 cm. and salt is allowed to crystallize without any disturbance and without permitting anyone to enter into the crystallizer beds, till the brine attains specific gravity of 1.257, when the bittern is discharged from the pans as completely as possible. Hard crust of 2-3 cm. thickness is formed. After the discharge of bitterns, fresh saturated brine is charged into the pans and regular manufacturing operations are started. The entire operation requires about 10 days. Contamination of soil with manganese is minimized by the addition of manganese sulphate at a later stage after the pan is stabilized first in the conventional manner. It is also possible to use manganese sulphate containing bittern together with make-up quantity of manganese sulphate for stabilization of other pan beds.

The data are presented in Table 1. Addition of manganese sulphate less than 0.005 per cent has not yielded any noticeable increase in hardness to the crystallizer beds; addition of 0.04 per cent manganese sulphate is satisfactory. The increase in bearing capacity is from 0.501 kg./cm.² to 0.703 kg./cm.² for 0.04 per cent manganese sulphate and 0.717 kg./cm.² for 0.06 per cent manganese sulphate added to the saturated brine. The bearing capacity of crystallizer beds will increase by increasing the percentage of manganese sulphate, but the problem of manganese contamination with the salt will arise. Instead, it will be better to maintain thicker bottom crust for obtaining the increased bearing capacity within reasonable margins. Again, this bearing capacity is satisfactory for the process of Kutch variety of salt and extraction of salt crop manually.

After working for two months, and with due care taken at the time of extraction of two salt crops manually heaping and removal
Table 1 — Bearing Capacity of Crystallizer Bed on Treatment of Different Concentrations of Manganese Sulphate

<table>
<thead>
<tr>
<th>Description of crystallizer bed</th>
<th>Bearing capacity in kg/cm$^2$ of crystallizer bed hardened adding to brine manganese sulphate (w/w), %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bed before formation of permanent salt crust</td>
<td>0.562 0.556 0.503 0.502 0.500 0.501</td>
</tr>
<tr>
<td>2. Bed with permanent salt crust</td>
<td>0.717 0.703 0.654 0.620 0.562 0.510</td>
</tr>
<tr>
<td>3. Bed as in 2 above after extraction of 2 crops</td>
<td>0.689 0.675 0.610 0.570 0.512 0.403</td>
</tr>
</tbody>
</table>

from the pans, the bottom layer has stood very well. The bearing capacity measured after working for two months is reduced to 0.675 kg/cm$^2$ for 0.04 per cent manganese sulphate, 0.689 kg/cm$^2$ for 0.06 per cent manganese sulphate added into the brine, while in the case of 'blank' the bearing capacity is reduced to 0.403 kg/cm$^2$. It is easy to maintain the bottom layer only with due care exercised as against in the 'blank' where in spite of precautions taken the maintenance of bottom layer is found difficult. The salt precipitating over this layer is devoid of any contamination of Mn$^{++}$. When the crust was broken after the experiment, it was found that the top crust had formed with bottom crust into a quite good collusion.

References