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SYSTEMS FOR THE MANAGEMENT OF RED MUD*

Prepared by

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Why Red Mud Disposal is Necessary

Alumina producers everywhere would much prefer to find a use for their red mud than to dispose of it as a waste product. That disposal has not yet been replaced by utilization is not due to lack of research into ways of making useful products from red mud. Disposal continues because of two facts :

- 1) Only the heaviest of industries e.g. road and building construction could use enough red mud to make an appreciable reduction in the tonnage to be disposed of.
- 2) When a use is found for large tonnages of mud, it is usually found that there are plentiful supplies of other raw materials for the same product e.g. limestone for road building in Jamaica.

Schemes for the extraction of small tonnages of relatively valuable materials from red mud, e.g. gallium, do not reduce the disposal problem.

The thought that economic utilization may become a reality (perhaps when some of the present alternative materials become exhausted) may influence the choice of disposal method when other factors are equal. In such cases, the method which leaves the red mud in one place, and in a form which would be easy to recover by future generations, could have the edge over

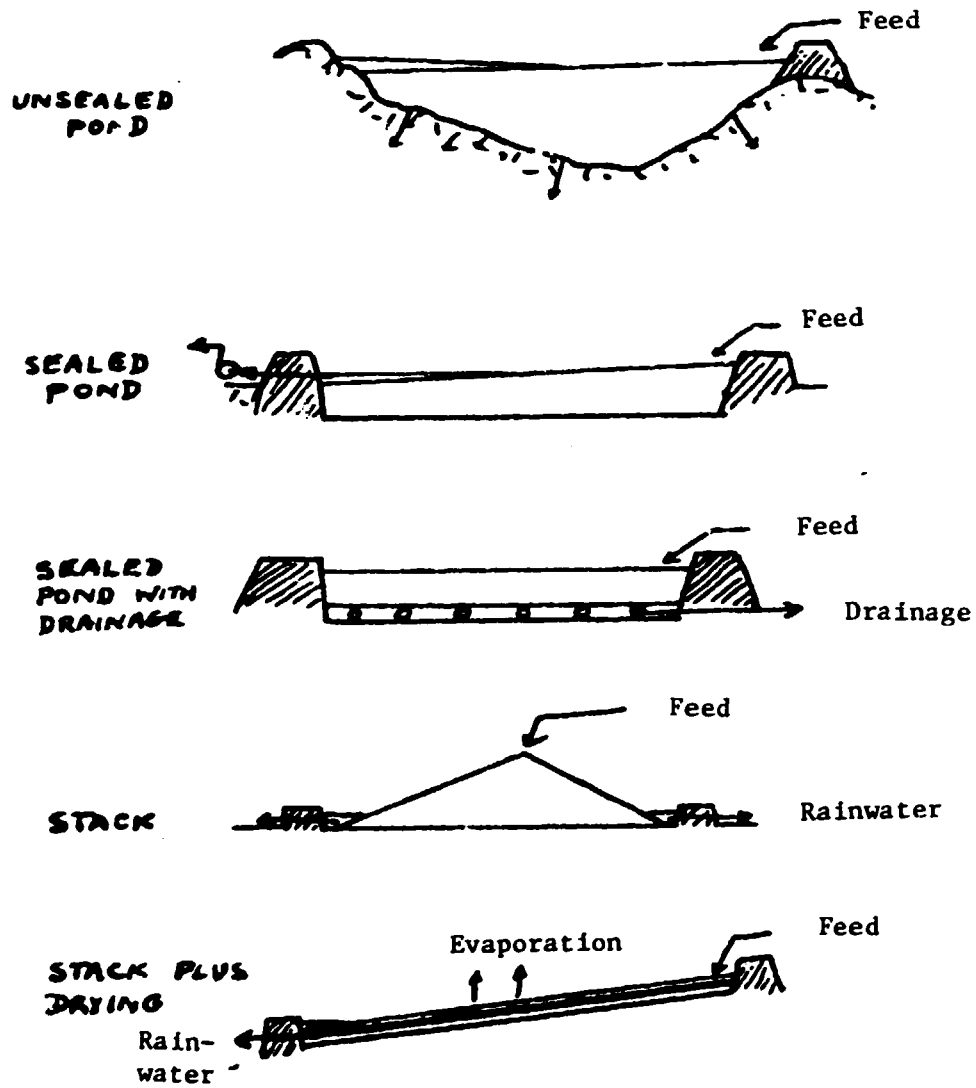


FIG. 1: Methods of Disposal on Dry Land

a method which makes it impossible to recover (e.g. disposal at sea).

Choice of Methods

There is no "best" method. Local conditions and local legislation affect the choice of mud disposal method, resulting in every one of the known and economically acceptable methods being used in at least one of the World's alumina plants. All of the following are in use now:

- 1) Weak slurry to unsealed wet pond (Jamaica).
- 2) Weak slurry to sealed wet pond (Canada, Jamaica).
- 3) Filtration, pumping and stacking (Spain, Ireland, Germany and U.S. Virgin Islands).
- 4) Filtration and trucking (India and Scotland).
- 5) Deep thickening, pumping and stacking (soon in Canada, Australia).
- 6) Deep thickening, pumping, stacking and drying (Jamaica).
- 7) Settling and drainage (USA).
- 8) Neutralization and river disposal (Brazil).
- 9) Neutralization, settling and disposal at sea (Japan).

Most of these are shown diagrammatically in figure 1. Several alumina plants are in the process of changing from one system to another, usually in pursuance of a cleaner and/or cheaper system.

Because a dollar change in the cost of mud disposal results in a dollar (more or less) change in production cost of alumina, cost is inevitably a major consideration in the choice of mud disposal system. In the present alumina over-capacity situation, a high-cost (however perfect) mud disposal system increases the risk of failure of the alumina plant.

Dewatering the Mud Slurry

For disposal on the land, the methods fall under two main headings - "stacking" or "non-stacking". The stacking methods all have at least one factor in common, which is that some special procedure has to be adopted to get the mud "thick" enough for it to stack. This involves the use of a solid/liquid separation operation to remove some of the liquid from the mud slurry. Such operations can produce a wide range of physical properties for the mud (from fluid to brittle) depending on the pressure used in the separation. This is shown in Fig. 2.

Choice of the solid/liquid separation process depends on how the product is to be transported to the disposal site:

If it is to be conveyed or trucked, it needs to be solid, and vacuum, pressure or high pressure filtration is called for -

If it is to be pumped through a pipeline, deep thickening produces a suitable consistency. Vacuum filtration can also be used but the cake needs to be reslurried with water before pumping.

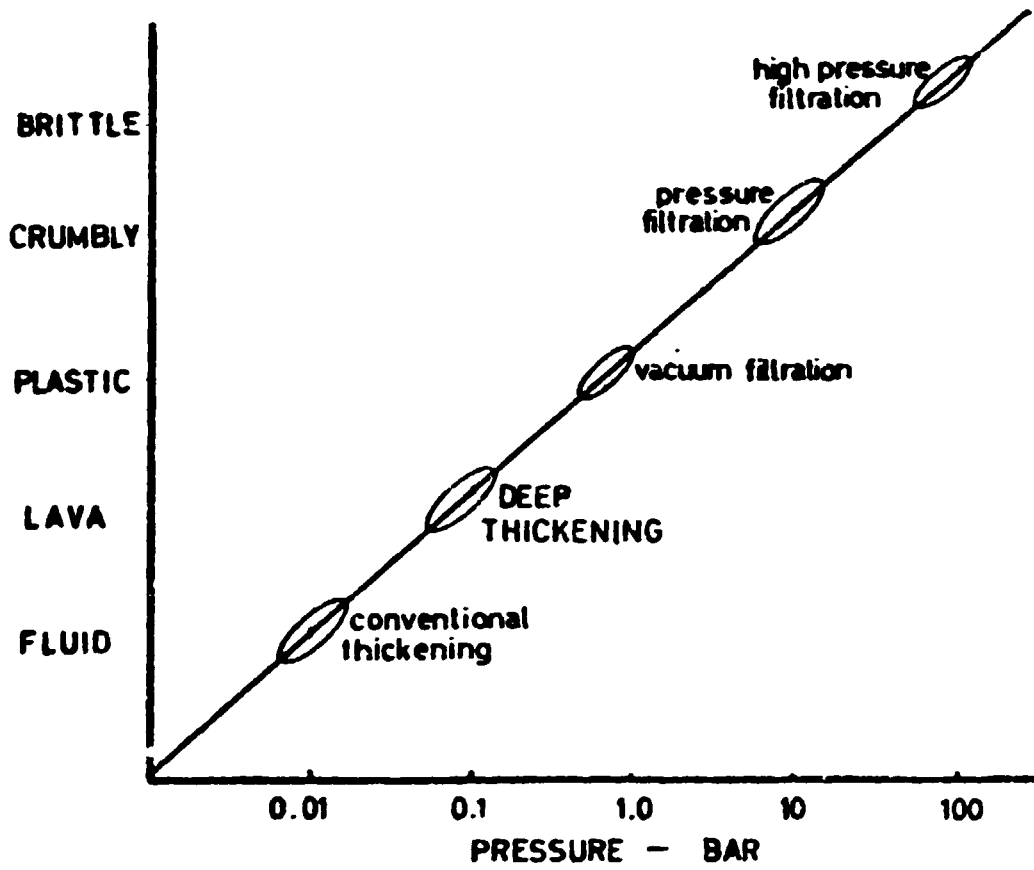


FIG. 2: How Pressure used in separation affects physical properties of red mud.

ALCAN'S MUD DISPOSAL METHODS

In Jamaica, Alcan is moving from method 1 above, to method 6, i.e., from an unsealed wet pond to a dry mud stack.

Jamaican red mud is peculiar in that it has a very fine particle size, holds much more water than other muds ("stackable" mud is 25% solids instead of 45-50% solids), and is very difficult to filter.

Deep thickening is used to de-water the slurry to stackable consistency, and it is then spread out to dry in thin layers on carefully graded slopes (4-5% slope). Each layer is allowed to dry (in approx. 15 days) before the next layer is applied. The result is a disposal stack of minimum volume and maximum compressive strength. No supernatant liquid separates from the thickened slurry. Rain which falls on the slope picks up some solutes, so it is collected from the bottom of the slope and returned to the alumina plant.

Downward seepage of solutes is prevented by locating the stack on clay soil.

Success of the Alcan Jamaica method results from a careful study made, over several years, of the relationships between slope, consistency of the thickened slurry, pressure needed to pump the slurry to the site, drying rate, and properties after drying.

A vital feature of this work was the development of a reliable and convenient method for measuring the consistency of thickened mud slurry. A modification of the standard Slump Test (already in use for concrete mixing) was developed for this and is in regular use.

Alcan's plants in Canada are moving to a similar disposal method, but without the solar drying step.