

Abstract: : A state of art vertical lime kiln is a latest technology to re-burn lime sludge, herein lime sludge pellet hydraulic machine is used to convert lime sludge in rock like hard pellets. In this process, Lime sludge of White liquor cleric disc filter or lime mud withdrawn from WLC is diluted up to 10% consistency and fed for centrifuge the silica and CaCO_3 in a series of hydroclone. Accept are taken to lime mud washers are having very less silica 1-3.5% depending upon stages and particle size. Rejects are collected in a separate washing system. Desilicate lime sludge undergoes to hydraulic lime sludge pelletization machine. These pellets undergo sundry for 15 days finally to state of art vertical lime kiln and can also be integrated to rotary lime kiln.

Key words: Lime sludge desilication, centrifuge, Lime sludge pelletization, integrating with rotary lime kilns

Introduction

WLCD/WLC mud is diluted to 10% or less consistency, this diluted consistency slurry is fed to hydro clone, Accept / overflow is taken to lime mud washers this lime mud now will have low silica. See fig.1. A continuous fixed proportion of slurry fed to hydroclone is withdrawn from bottom and collected for washing in different street, because underflow contains substantial amount of silica in underflow lime mud. Albeit particle density of SiO_2 and CaCO_3 are very close but due to different sizes of sand Silica, SiO_2 , $\text{Ca}(\text{SiO}_2)_3$ and so many form we have been successful to reduce this to 3.5 from 7% in single stage. It can further be reduced up to 1.5% in 2-3 stages.

State of Art Vertical Lime KILN



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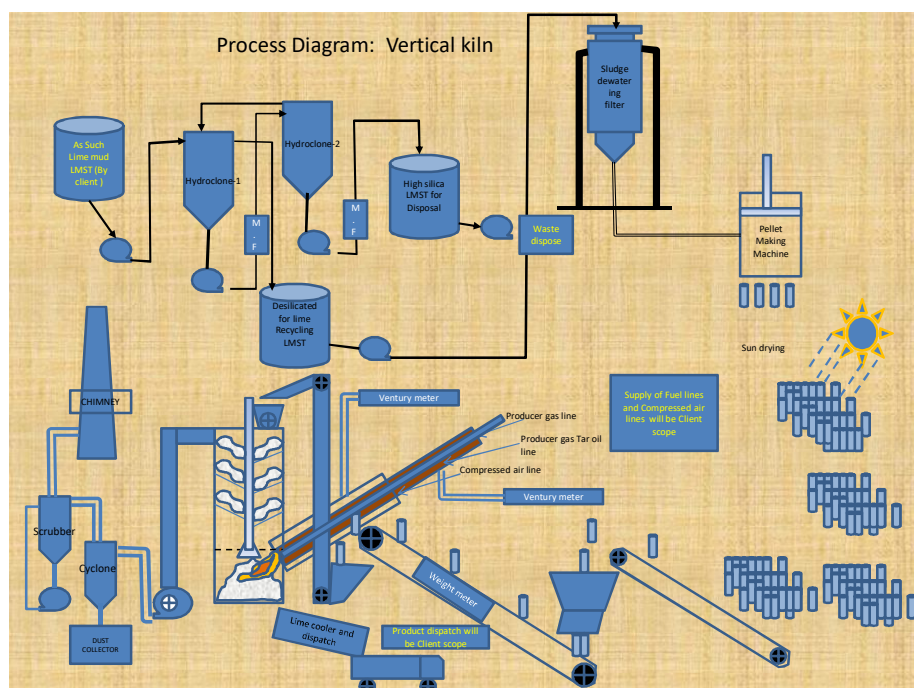


Figure 1

Desilicate lime sludge undergoes for pelletization by lime sludge hydraulic pellet machine see fig.2, these pellets lime sludge pellets were as hard as real lime stones and having average dryness of 65%. These pellets can be staked as well for natural drying and after 15 days achieves as high as 85% dryness. Once sufficiently staked and dried pellet will come to the vertical lime kiln after 15 days. Flue gas passing through these pellets is having very good heat transfer and radiation losses are very low compared to traditional rotary lime kiln. Finally partially cooked pellets come over a rotating disc where it is burned using F.O/Natural gas/Producer gas/Methanol/others. Hot cooked lime is taken out from this vertical lime kiln by an obstruction gate.

Material and Methodology: In this process WLCD scraped off mud / WLC under flow mud is dilute till 10% consistency, now this slurry is fed to a series hydroclone where from over flow accepted send to lime mud washers is. From these hydroclone tail ends a controlled amount of slurry is withdrawn and this proportion is having highest silica content so washed separately and finally disposed off. Lime sludge obtained from lime mud washers is having as low silica as 1%. This low silica lime mud under goes lime sludge pelletization. These pellets we developed are having size 250MM Dia and 300 mm long. These pellet are stored a specially designed platform number 1-30, Like one above another

made up of grating. These pellets are having dryness of 65-67% and as hard as lime stone fig 6. These pellets after 10-15 day attain naturally 85-90% dryness see fig.3. These pellets are fed to the state of art vertical lime kiln. Advantage of this system is there is no need of enough free space for flue gas to pass without creating much dusting. Heat transfer from flue gas to pellets is good see fig.4. This is why it good and profitable and you need not think of purchase lime and it's logistic. Fig 5 is actual commercial pellet machine.

By integrating this system one can reduce furnace oil in rotary lime kiln too, as well as capacity of rotary lime kiln can be increased. In Rotary lime kiln,

only 10% volume is filled with lime bed, Mud fed usually having dryness 60-75% mill to mill. Mills those have achieved 75% dryness of mud, even their fuel consumption is 7-7.5 GJ / Mt CaO. Because radiation losses and losses through flue gases are high.

Across the country Fuel requirement for recycling lime sludge back to Calcium oxide by rotary lime kiln is from 10.5 to 13.5 GJ/Mt lime at 80 +/- 2% Purity. But you will be surprised that Theoretical fuel requirement to produce 1 mt lime @ 80% purity from 100% pure lime stone is only 2.6 GJ .

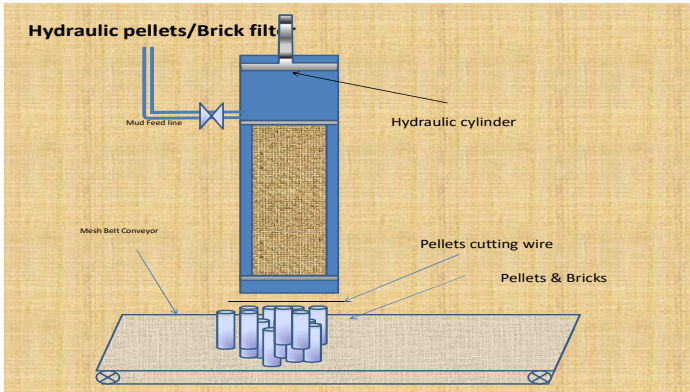


Figure 2

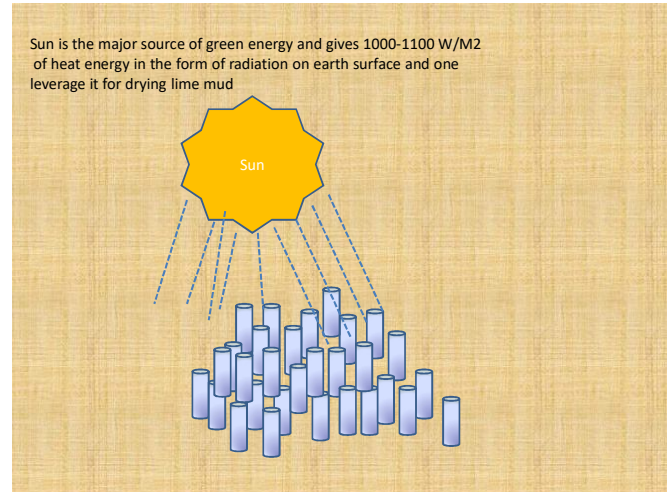


Figure 3

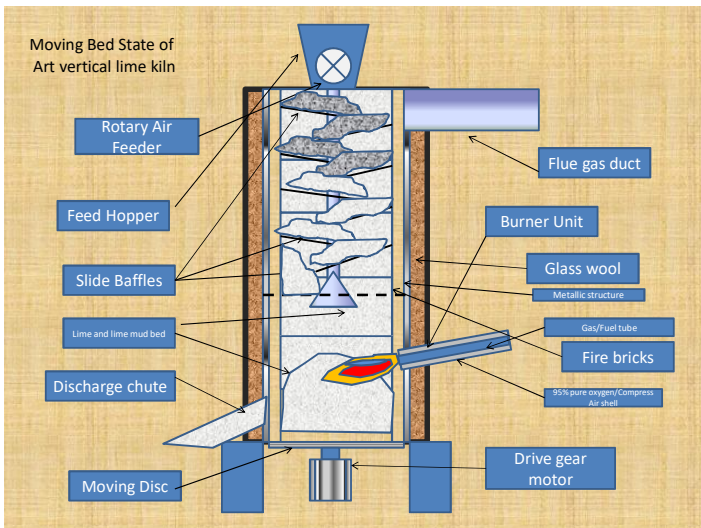


Figure 4



Figure 5

Result and discussion: In our patent process we desilicate lime sludge by centrifuge and decantation system where in, we been successful to reduce silica from 7.5% to 3.5 % in just single stage, this Sludge undergoes for pelletization followed by natural drying then feeding to either vertical lime kiln or rotary lime kiln through flash dryer. Expected fuel requirement is only 4.2 GJ/Mt by this technology.

Conclusions: In rotary lime kiln substantial fuel consumption can not be reduced even after lime mud dryness of 85% , Some of the mills have achieved as high dry as 80% of lime mud over vacuum drum/ LMCD filter but there fuel consumption are still 165kg/Mt CaO. More dryness one may have more dusting issue at feed end as well as ESP inlet. To get rid of mills should go for pelletization followed by sun drying pellets to a vertical counter current flash dryer. Flue gas must pass through this flash dryer through the pellets. Reasons of low dryness are Silica. 90-95% of the silica source is sand, Sand size is 1mm and above, Silica and CaO density although very close but particle size of CaCO_3 is less compared to Silica. By centrifuge technique Silica can be reduced. We must also focus on other sources like wet washing of raw material.



Figure 6