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ECO-Friendly Synthetic Oil for Mill Roller Lubricantion - Experiment and Outcome at Gandevi Sugar

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INTRODUCTION

Sahakari Khand Udyog Mandli Ltd., Gandevi, situated in South Gujarat (India), is today a leading Sugar Mill in India. Under the Leadership of Honorable Chairman Shri Jayntibhai Patel, Gandevi Sugar has grown all around & beyond. Its main technical hand, Mr. Ganesh Patil (MD) with his team has successfully accepted, introduced & applied modern technology driven Projects / Systems / Products to enhance the operational efficiency of Gandevi Sugar, both in Process (Software) and Products (Hardware). The factory is reaping its benefits year after year.

Era has come for single Milling Tandem to face international sugar-sale-competition. Gandevi Sugar has always adopted the concept of Single Milling Tandem, e.g. while expanding its capacity from 2000 TCD to 3500 TCD in the early nineties, the factory opted for replacement of its earstwhile 30" x 60" size milling tandem by a new tandem of 38" x 78" size. Later on, pressure feeders were added to achieve the present capacity of 6500 TCD through single Milling Tandem.

G.D.Patil- Managing Director, B.D.Pabsetwar-Works Manager

Gandevi Sugar has adopted many technological developments on first to first come basis under the guidance from its Board of Directors and Senior officers. Definitely, it has given upper edge in highly competitive regime & staying ahead as a Leader in our region. Some of the initiatives that have been successfully implemented are listed below:

- Foreseen the market trend and exported sugar to consolidate fiscal of the balance sheet. (Trend setter)
- Implemented DCS based automation of Boilers. (Improvement in Boiler Efficiency).
- Implemented PLC based automation of Mills, Pan Station and Centrifugal Battery. (Improvement in Sugar Recovery % Cane)
- Installed Harmonic Filters (Conservation of Energy).
- Implemented best HR practices which has created Harmony at all level and in all department, resulting in getting best out of all employees towards common Goal of the Leader.

As a result of above, Gandevi Sugar Factory has achieved average recovery of 12.31% cane for the season 2013-14, which is all time highest in the history of Gujarat Sugar Industry.

In Nutshell, Gandevi Sugar has been First of its Kind to apply latest Technological and Management Principle and Practices.

Today, we are here to announce and publish our one more achievement i.e. successful use of eco-friendly synthetic oil for Mill Roller Lubrication. Please find herewith our experiment & outcome for betterment of sugar fraternity.

CONFIGURATION OF MILLING TANDEM

We are having 4 Nos. Mills, each having 6 rollers (i.e. 3 roller mill followed by heavy duty GRPF and grooved underfeed roller). The Mill size is 38" dia x 78" length and the journal size is 470 mm dia x 600 mm. The Mill / GRPF roller bearing comprises of cast steel housing with gun metal liner. There is a common turbine drive for each Mill and its GRPF.

EXPERIENCE WITH CONVENTIONAL BITUMINOUS LUBRICATING OIL

Earlier we were using SM-175 Bituminous oil at the mills. Our consumption was 240 litres / day.

We had lots of ETP load i.e. 240 litres x 180 days = 43,200 litres per season and faced Pollution Control Board issues. To avoid such issues, like other mills, we too spent at least Rs. 2 lac for oil separation at ETP.

In year 2010-11, we have started concentrating on Mill area. We then installed a Centralised Lubrication System at the Milling Tandem to monitor and penetrate right quantity of lubricant in each mill roller.

The above Centralised Lubrication System with a high pressure pump having reversing pressure of 200 bar, with control panel and modular dose feeder with adjustable doses has helped us to regulate the quantity of oil at each bearing level on drive as well as non-drive side of individual mill roller. Total oil consumption was reduced to 140 litres/day from 240 litres/day.

But this could not eliminate the problems at ETP due to presence of large quantity of oil in the effluent. Apart from the above, there was the usual problem of wear out and maintenance of the bearing liners and mill roller journals every off-season.

THEORY OF LUBRICATION

Figure 1 shows the STRIBECK curve for lubrication condition. In respect of mill roller, the linear speed at the contact point is low but the loads are high. It is clear from this curve that hydro-dynamic lubrication condition is the best for mill roller journal.

Figure 2 shows the advantages of hydro-dynamic lubrication alongwith advantages of synthetic lubricating oil as compared to the conventional bituminous oil.

ECO FRIENDLY SYNTHETIC LUBRICATING OIL

New revolutionary oil, called LAAPSA, was suggested to us for mill roller lubrication by Lubeman Engineers (P) Ltd., Faridabad through their Gujarat office. This oil is imported from Argentina. The recommended grade for mill roller bearing is Sugarpress BR – 1000 and its characteristic is furnished in Table -1. This is non-bituminous synthetic oil. It is bio-degradable and hence eco-friendly.

Experiement at Gandevi Sugar Factory

Our experience with the centralised lubrication system gave us confidence to go advance and adapt Eco-friendly and new technology synthetic LAAPSA oil for the mill rollers.

We took trial in season 2010-11 (Feb, March & April) for 66 odd days.

We could bring down consumption of oil at the mills from 140 litres/day of SM-175 Bituminous oil to 45 litres/day of Sugarpress BR 1000 synthetic oil by the end of trials in the season 2010-11.

We find it is more user friendly oil and avoided all major issues related to ETP, floor cleaning etc. Hence we decided to use LAAPSA from the beginning of the next season 2011-12, when after 60 days of usage during the month of November and December 2011, our consumption of LAAPSA was reduced to 36 litres/day from 45 litres/day last year.

After 60 days, we have gone more scientific, advised and supported by LAAPSA engineers for further reduction of consumption. From Jan to April 2012, consumption was only 33 litres / day.

We observed that during the season 2011-12, the mill roller bearing housing temperature was around or below 40^{o}C and there was no need to use extra water on the bearing housing as external cooling agent.

We, at the same time, have observed that all parameters have been maintained as above till season end. We did not find any wear of mill journal, even a scratch and hence no maintenance was required in the off-season. It saved indirectly repair cost of Journal Bearing.

In view of the above benefits, season 2012-2013 also was started with Sugarpress BR-1000. This year i.e. 2013-14, LAAPSA – Argentina has deputed their experienced engineer Mr. Leandro along with local engineer Mr. Bhadresh Nagori for **"Fine Tune**" the usage of oil. With all our optimum resources and their efforts, we could achieve further reduction in consumption of Sugarpress BR-1000 to **25 litres/day.**

Advntages of Sugarpress Br-1000 for Mill Roller lubrication

- High viscosity leads to shaft flotation and hence no wear and tear of mill rollers bearings. This is evident from Figure 3 which shows the physical condition of mill roller journals / bearing liners after operation of the mills for 3 years using the above oil.

- There are no solid additives**,** added to make oil viscous. It is clean lubricant.

- Floor and area surrounding the main mills remains clean and hence eliminates accidents due to slippage of workmen. This is evident from Figure 4 which shows that there is no leakage of surplus oil from the mill roller bearings.

- It is a Biodegradable, non – toxic lubricant and can be a food-grade.

- It can take very high load i.e. 200 to 250 kg/cm2. Hence the mill can run at lower speed and higher hydraulic load. We have been operating our mills at about 3 rpm while crushing at 6500 TCD. This has resulted in higher juice extraction.

- Oil consumption savings i.e. only 20% as compared to bituminous oil.

- High protection against seizure and wear of mill roller journals and therefore avoiding expensive repairs.

- Due to film maintained at 100˚C, it protects mill roller brasses by resisting water–wash-out and abrasive contaminants.

- **Having enough Thermal Stability & Oil Film maintained at high Temperature, shaft floats** and hence there is **no "FRICTION"** between shaft and mill bearing. **It consumes less energy and thereby save upto 2% of the power for mill drives.**

Financial Benefits

- Saving in the cost of bearing liner replacement
- Saving in the cost of mill roller shaft repair
- Savings in expenditure of oil separation cost from effluent.
- Saving in cost of labor required for mill cleaning.
- Improvement in productivity

  With the use of asphaltic oil, lubrication film cannot be maintained on a sustainable basis. As a result the hydraulic pressure on the mill top roller needs to be reduced resulting in loss of juice being extracted. With the use of SugarpressBR, the oil film is maintained even at high pressure and thus ensures maximum productivity.

- Saving in Mill Downtime
- Higher revenue for factories having cogeneration.

  Assuming 1% saving in mill drive power, addition revenue per annum (assuming season of 180 days) shall be as under:

  a. Power consumption at Mills (KWh) = 3000 kw
  b. Estimated Power Saving = 1%
  c. Sale Price of electricity per KWH (Rs.) = 3.50
  d. **Additional revenue by reducing friction** = **Rs. 4.5 Lacs** (3000*1%*24*3.5*180)

  For Different mill sizes, above said benefits are different.

Other Tanagible / Intangible Benefits

Sugarpress BR is a group of Premium fluids made of a blend of organic and synthesized hydrocarbons, resulting in “gel-type “compounds with tixothropic properties. This will ensure a lubricating film with superior viscosity, capable to resist the highest load stresses in the large roller mill’s thrust bearings of the extraction process.

Its structure conformed by special polymers of high resistance to the deformation generates a very high hydraulic resistance; its stability, high thickness and its adhesiveness conform a ring that remains and seals the brass bushings, resisting the water-washout, and avoiding the entrance of pollutants as juice and bagasse.

The additive chemistry of the **Sugarpress BR** resists the high temperatures generated between the friction elements avoiding seizure.

Clean Work Environment:

With the application of **Sugarpress BR** there in no need to apply external cooling water that washes out oil with it making mill area too dirty to walk around and check the mill components.

The mill surrounding can be kept dry all the times. Needless to mention that unmeasured water used for brass cooling also takes lubricant along with it to process house.

High Employee Morale: Fpower

Generally the focus of mill operating personnel is to keep the mill brasses working at normal temp. The operator operates the mill with zero hydraulic loads or at high speed or low through put to until brass cools down. With application of **Sugarpress BR** operators are free from this trouble and get enough time to do other important preventive checks to improve productivity that results in keeping their morale high all the times and love their job.

We express our very sincere thanks to the Hon. Chairman Shri Jayantilal B. Patel for encouraging us to motivate us.

Courtesy By:

LAAPSA Lubricants Ltd. **Argentine**

www.laapsa.com

Lubeman Solutions. **Faridabad (India)**

www.lubeman.in

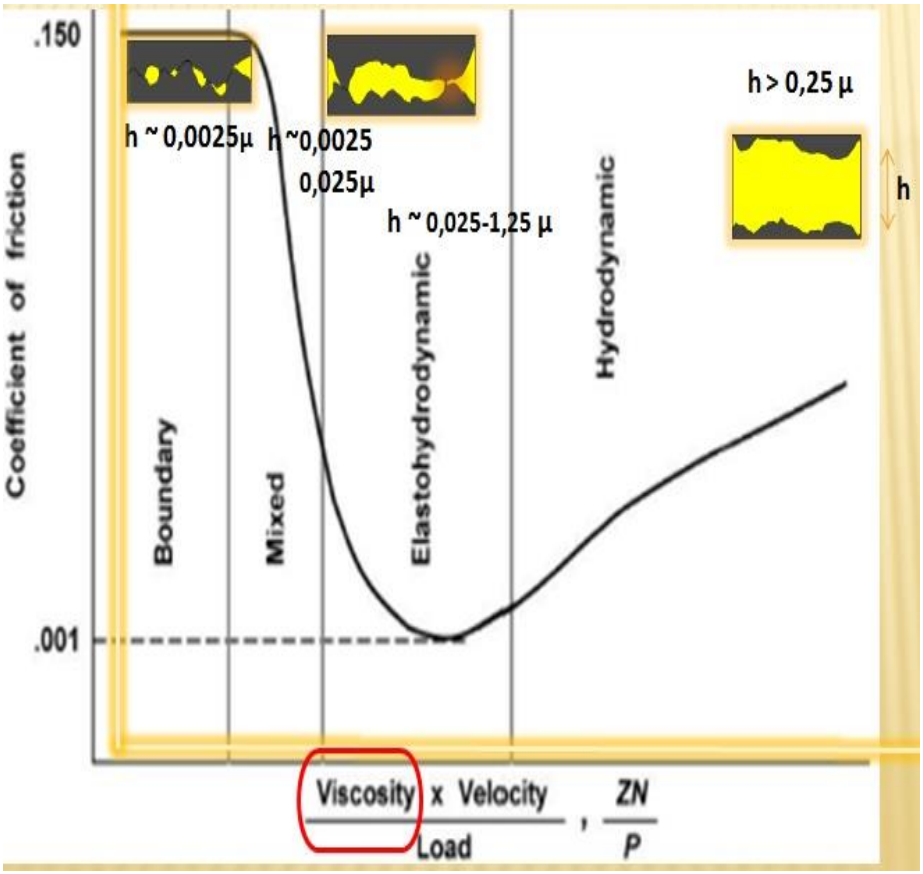
K. G. Corporation **Gujarat (India)**

www.bhadreshnagori.com

TABLE – 1 : Characteristics of Laapsa Oil

Viscosity **ASTM D445, D2161:**	**Sugarpress BR-1000**
@ 40˚ C, CST	20,000
@ 100˚ C, CST	1000
Colour	Amber
Specific Density ASTM D1298, @ 15,6˚C	0.90
Flash Point ASTM D92, COC,˚C	>240
Evaporation loss 100˚C	<2% Weight
Copper corrosion ASTM D4048	1A
Four Ball EP, ASTM D2596 Weld Point, Kg.	>800
FZG/By Din 51354 method A/2.76/50	>12
Service temperature,˚C	-5 to 150

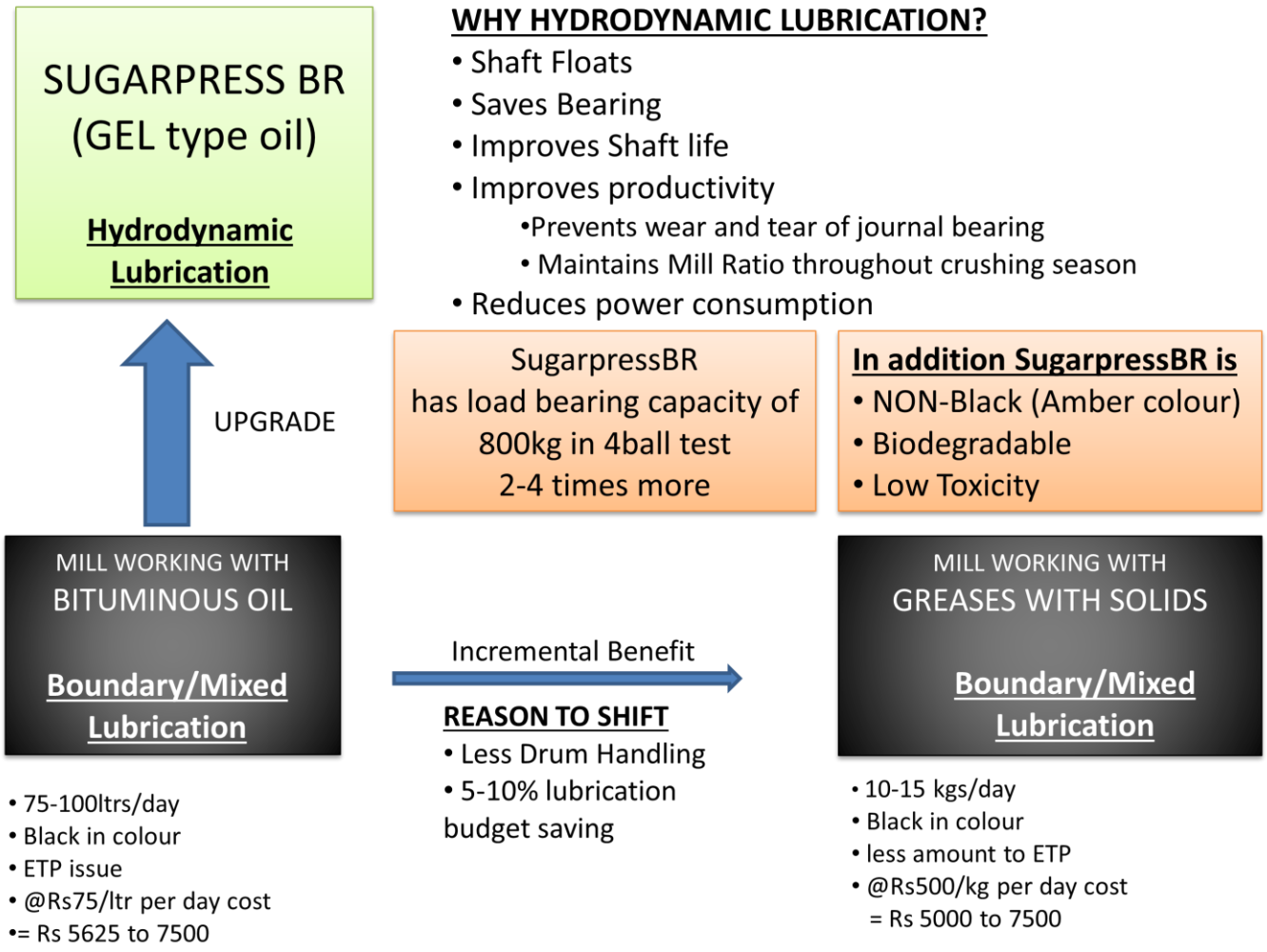
Figure – 1 : STRIBECK CURVE FOR LUBRICATION CONDITION



- Lubrication condition improves as we move from left to right on the given curve from boundary lubrication to Hydrodynamic lubrication.
- In reference to sugar Mill, Velocity & Load are Mill parameters.
- Lubrication condition can only be improved by increasing viscosity of lubricant.
- In Hydrodynamic condition the lubrication film is >0,25µ

in "boundary lubrication" regime, must have EP capacity necessary to prevent micro-welding when the lubricating layer is thin (four-ball test, ASTM D 2783 , weld load ≥ 620 kg).

Figure – 2



- **Meet ISO 22000 requirements**
- **Thereby, Mill Engineer can go up to highest hydraulic load to achieve maximum crushing.**

Figure – 3 : See the good condition of Brasses.

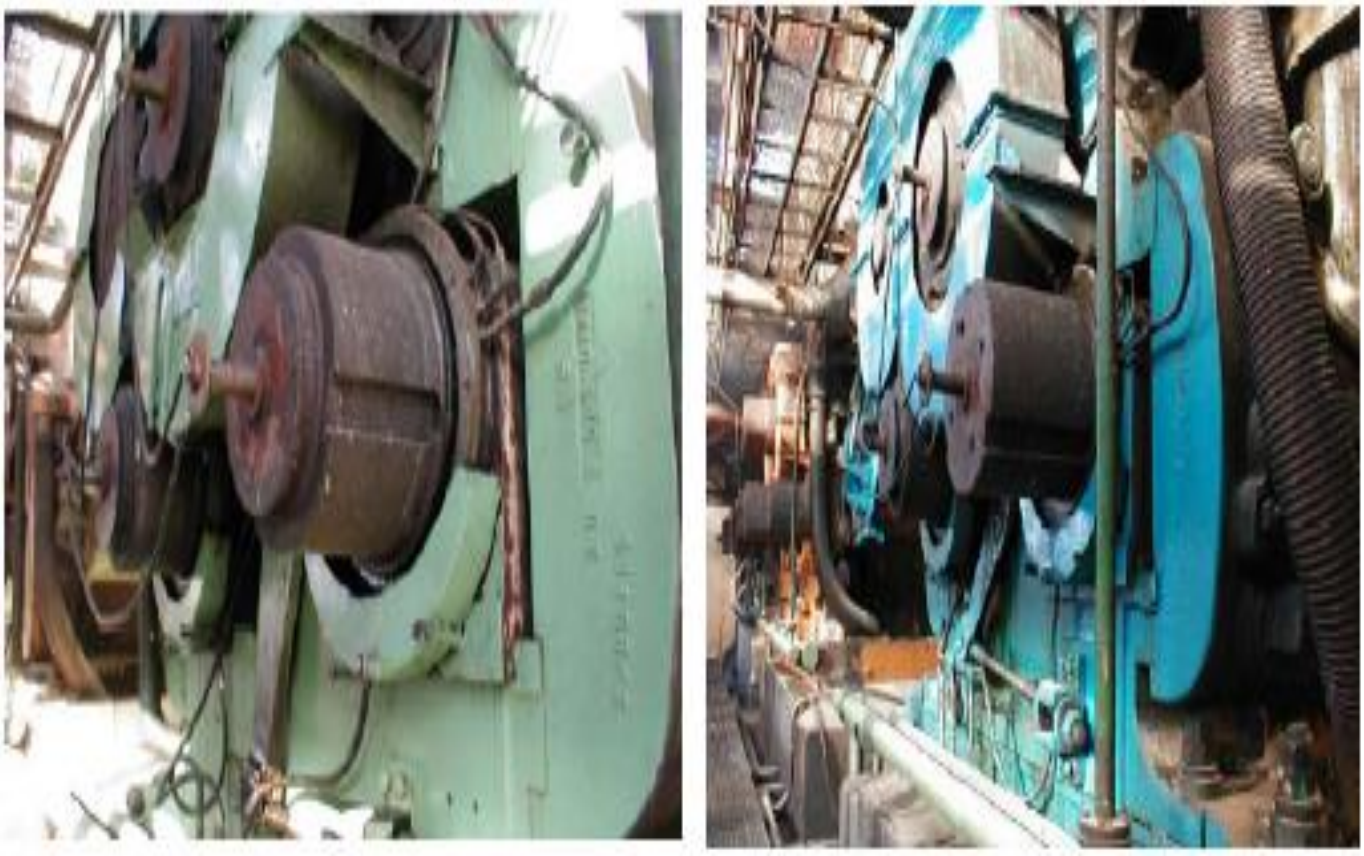


Figure – 4 : The absence of spills on the floor staff prevents accidents