

INSTALLATION OF AGITATED NUTSCHE FILTER DRYER (ANFD)

(For Ankleshwar Chemical Cluster)

Cluster Brief:

The state of Gujarat is a major contributor in the production of basic chemicals as well as petrochemicals with 54% and 59% as compared to the production in other parts of India, respectively. Also chemicals/petrochemicals and pharmaceutical sectors contribute about 60% in the entire manufacturing output of Gujarat. About 50% of the total chemical production in Gujarat is contributed by industries in Ankleshwar making it the most significant chemical cluster of Gujarat and India. Industrial Estate was set up by the Gujarat Industrial Development Corporation (GIDC) in the 1970s. The industrial estate has more than 1,200 industries manufacturing diverse range of chemicals, pesticides, pharmaceuticals, bulk drugs, petroleum products, engineering, textiles, plastics, rubber, and packaging. Of these 1,200 units more than 600 are MSME units manufacturing various types of chemicals, like dyes, pigments, insecticides, specialty chemicals, petrochemicals, pharmaceuticals, and paints. A lot of basic chemicals are used as raw materials to manufacture major chemical products. These basic chemicals used as raw materials are classified according to a variety of features: their chemical composition (organic and inorganic), their origin (mineral, vegetative, and animal), and their state of aggregation (solid, liquid, and gaseous). Majority of the industries located in Ankleshwar are wet processing units which requires high amounts of thermal energy along electrical energy in the form of steam and thermic-fluid, leading to a high share of energy cost. The sector is unorganized in nature, mostly using old and inefficient technologies. There is a significant potential to make these units energy efficient and cost competitive, through accelerated adoption of energy efficient technologies in the cluster.

Existing practice:

Majority of industries producing Pharma intermediates are using Centrifuge (for filtration) and tray dryer (for cake drying using hot air generated in HAG) , which are inefficient and thus result in loss of energy during filtration and drying. Centrifuge requires more man power to handle cake and consumes too much time in one batch. Electricity is also consumed in tray dryer for air circulation and for supplying combustion air in hot air generator. There are lot of design flaws in conventional tray dryer system which includes uneven spacing between the trays, poor efficiency of propeller fans, no partition between fans and lots of air leakages. All these things lead to increase in drying time; this lead to increase in energy consumption in hot air generator. There are several disadvantages of centrifuge which includes down time for clearing lower efficiency, can only use for feed with lower solid content and pre-screening may be necessary to weed out particles too large to fit through the nozzles. Both centrifuge and tray dryer is two different units and operation is not continuous due to manual collection of wet cake from centrifuge.

It is recommended to replace both centrifuge and tray dryer (HAG) with Agitated Nutsche Filter Dryer (ANFD). ANFD is suitable for non-sticky products.

The following table shows the number of centrifuge and tray dryers are installed in audited units:

Table 1: Centrifuges and Tray dryers

Units Name	Numbers of centrifuge	Number of tray dryers
<i>Rashdeep</i>	2	
<i>Minol acid</i>	5	2
<i>Blitzkrieg</i>	1	
<i>Pragna</i>	10	
<i>Prudence</i>	4	5
<i>Movie coat</i>	1	
<i>Pooja</i>		
<i>Ridhi</i>	9	

Proposed technology:

Existing centrifuge and tray dryers are of very primitive design, it is recommended to replace centrifuge and tray dryer/ only centrifuge with scientifically designed Agitated Nutsche Filter Dryer (ANFD) by considering moisture level in powder produced, characteristics of slurry and slurry holding capacity etc. By considering these parameters into the design of ANFD system will reduce the down time and improved moisture level, this will improve the quality of the final product. Additional advantages are listed below:

- Improved product quality
- Reduction of drying time, it automatically leads to energy savings
- Productivity improvements
- Uniform moisture content in wet cake
- Environmentally safe, completely closed system, no toxic emission
- Solvent recovery to the maximum extent
- Controlled quantity of wash water
- Space, energy and labour savings
- Fully automatic operation can run the machine in complete auto mode
- Single person can operate two/three ANFD
- Semi skilled person can operate the machine
- In built safety system makes the machine safe
- Minimum maintenance required due to hydraulic system
- Detachable bottom version for toxic and frequent change of products
- Quick changing filter cloth arrangement provided

Justification of technology selection:

The proposed technology of ANFD not only helps to improve product quality but also can save time (it automatically leads to energy savings), reduce fuel consumption and electricity consumption. The improvement envisaged through the installation of the system has been summarized in the table below:

Table 3: Performance parameters of ANFD

Parameter	Current Operation	Ideal Scenario	Operating Performance	Effect on reactor	Post Implementation of ideal scenario
Batch time	65 h/batch	13h/batch (ANFD leads 80% time reduction in filtration and drying)	More involvement of labour and two separate system lead more down time	Installation of ANFD will reduce man hours, fuel consumption and electricity consumption which help to maintain specific energy consumption within limit	
Fuel consumption	50 SCM/batch	Nil (N ₂ Bottles use for drying purpose in ANFD)	Poor filtration leads more fuel consumption in HAG for supplying hot air in tray dryer	Installation of ANFD reduces fuel consumption in HAG which helps to improve specific fuel consumption within limit	
Power consumption	18 kW	16 kW (less machinery required in ANFD)	Most machines are required in both centrifuge, tray dryer and HAG	Installation of ANFD will reduce electricity consumption which help to maintain specific energy consumption within limit	

Estimated Energy & monitoring saving:

Capacity of ANFD will depend upon reactor capacity which is having capacity range from 1kL to 20 kL at Ankleshwar Chemical Cluster. For calculating the energy and monetary benefits, a representative case of reactor of 5 kL capacity has been considered. The benefits envisaged through installation of Agitated Nutsche Filter Dryer (ANFD) have been summarized in the table below:

Table 4: Cost benefit analysis for ANFD

Particulars	Unit	AS IS	TO BE
Time taken for filtering	h/batch	25	5
Time taken for drying	h/batch	40	8
Time taken for filtering and drying	h/batch	65	13
Wet cake processed	kg/batch	3,500	3,500
Power consumption	kW	31	31
Daily man days	#	4	1
Man hour	h/batch	100	5
Monthly salary	Rs./month	15,000	15,000
Hourly salary	Rs./h	42	42
Expenses over labours	Rs./batch	4,167	208
Monetary savings			3,958
Annual batches	Batches/y		45
Annual monetary savings – A	Rs. Lakh/y		1.78
Inlet moisture	%	20%	20%

Particulars	Unit	AS IS	TO BE
Exit moisture	%	1%	1%
Efficiency of HAG	%	75%	75%
NG consumption in HAG	SCM/batch	50.4	0
Annual NG savings	SCM/y		2266
Annual monetary savings – B	Rs. Lakh/y		0.88
Power requirement	kW	18	16
Power requirement	kW/batch	442	78
Electrical savings	kW/batch		363
Annual savings	kWh/y		16,349
Electricity tariff rate	Rs/kWh		7.30
Monetary savings in electricity- C	Rs. Lakh/y		1.19
Estimated investment of ANFD	Rs. Lakh		9.24
Total monetary savings	Rs. Lakh/y		3.86
Simple payback period	y		2.4

* extracts of calculation provided

The benefits can be summarized as:

- ✓ 10-15% reduction in specific power consumption
- ✓ 80 % reduction in down time

Replication Potential:

Ankleshwar has a large number of chemical processing units forming clusters around common effluent treatment plants (CETPs). The Ankleshwar Industries Association (AIA) is the biggest association operational in the cluster, with close to 600 registered chemical units. To establish the replication potential of the technology in the sector, the following were considered:

- ✓ Technology feasibility and adaptability through energy audits in 8 units.
- ✓ Survey of 100 units (under process)
- ✓ Meetings held with associations / stakeholders (including technology suppliers)

The technology of Agitated Nutsche Filter Dryer (ANFD) has huge demand, with 23 out of 100 surveyed units so far, showing interest for the technology. However, while analyzing the preference of the units on the list of technologies, the technology of 'Installation of ANFD' is 2nd in the list after 'installation of IBR boiler'.

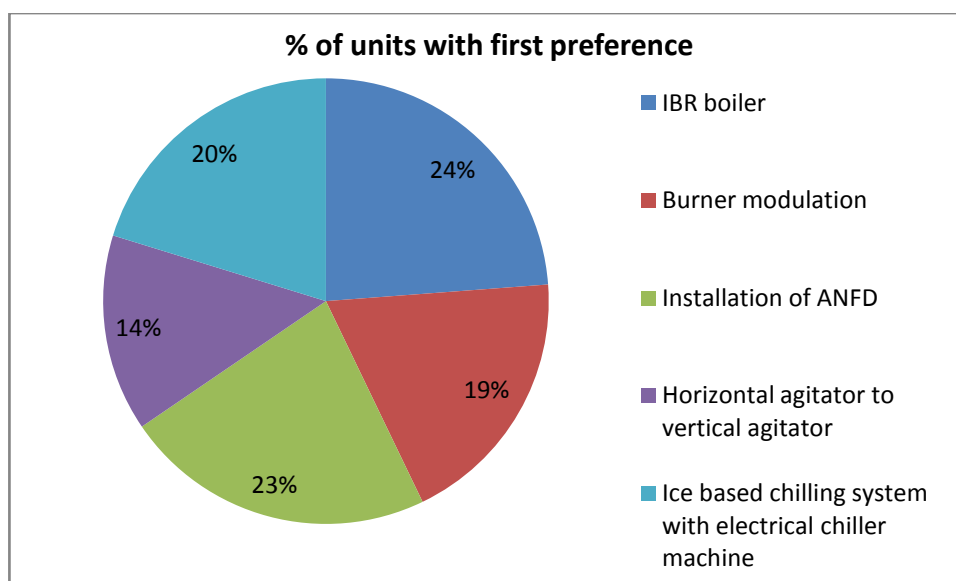


Figure 1: Summary of survey results

As seen from the above, 23% of the units out of 100 surveyed units till date, has opted for 'Installation of ANFD' as the first preference for implementation.

Considering the survey results and based on further discussion with associations, units, stakeholders and outcome of the energy audits, it is estimated that the technology has a replication potential of 3.8% in the cluster, i.e. 23 units. Based on 3.8% replication, the overall project benefits will be as follows:

Table 5: Impact of replication of technology

Parameter	UoM	Value
Annual thermal energy saving (one unit)	scm/y	2,266
Annual thermal energy saving (one unit)	MJ/y	90,192
Annual electrical energy saving (one unit)	kWh/y	16,349
Annual electrical energy saving (one unit)	MJ/y	58,857
Annual total energy savings	MJ/y	149,049
Annual electricity saving (considering 3.8% replication)	kWh/y	376,027
Annual energy saving (considering 3.8% replication)	MJ/y	3,428,127
Annual CO ₂ emission saving (one unit)	tCO ₂ /y	17.8
Annual CO ₂ emission saving (considering 3.8% replication)	tCO ₂ /y	408.5
Estimated investment in technology (one unit)	Rs Lakh	9.24
Estimated investment in technology considering 3.8% replication (assuming price down due to demand aggregation)	Rs Lakh	212.5
Total Investment	Mn USD	0.3
Total energy savings (in 10 years)	TJ	34.3
Annual CO ₂ emission saving (in 10 years)	tCO ₂	4,085

Barrier for implementation:

Although the technology has been successfully proven; there has been limited replication of the technology in the cluster. The barriers identified for limited penetration of the technology in the cluster are as follows:

- ✓ **Knowledge barrier:** Based on discussion with units, it has been found that knowledge dissemination related to the technology has been limited. Agitated Nutsche Filter Dryer (ANFD) is suitable for non-sticky chemicals only. Candle filter is suitable equally for both sticky and non sticky slurry
- ✓ **Lack of after-sales service:** The technology penetration has been limited due to the lack of after sales service. The delay in such services forces the units to bypass the automation system. The annual maintenance contract and warranty, which has been inbuilt in the present model, is expected to take care of the issue.
- ✓ **Lack of skilled manpower:** The technology requires skilled manpower and /or training within the existing manpower to operate the system at optimum level. Such training has been incorporated in the model.
- ✓ **Risk related to implementation:** The units lacks confidence related to performance of the technology. The risk of performance has been covered under the project. **Lack of monitoring instruments:** Not clear about their existing level of operations and efficiency, due to lack of instrumentation & non availability of energy consumption data
- ✓ **Narrow focus on energy:** The units have much interest in production figures and committed for target production
- ✓ **Limited manpower:** Implementation of new technology in unit may require skilled man power which is also a barrier

Availability of technology supplier:

The technology of Agitated Nutsche Filter Dryer (ANFD) has been well established. A large number of reputed technology suppliers cum integrator are involved in supply and service of the technology. Most of these technology suppliers have local offices / representative at Abkleshwar. In addition to the established names, a large number of smaller system integrators are also involved in the supply of this technology. Some of the established technology suppliers are:

- ✓ BEW Engineering Pvt. Ltd.
- ✓ Shiv Shakti Process Equipment Pvt. Ltd.
- ✓ GMM Pfaudler Ltd.