

STANDARD OPERATING PROCEDURE (SOP) for Bio-composting operation for Molasses based distilleries

S.No.	Particulars	Time range
1.	Distilleries with covered shed bio-composting may be allowed to operate throughout the year and those without covered shed shall be operated 270 days (excluding monsoon season)	
2.	Press mud may be directly laid in the bio-compost yard or properly stored for consumption the rest of the year.	-
3.	Feed stock received as combination of press mud, yeast sludge and boiler ash in press mud yard or plant as per requirement from sugar industries. Average Moisture content after testing : 70±5%	-
4.	Areas for Press mud storage, Bio-compost operation, Finished goods storage must be properly demarcated.	-
5.	Windrows laid shall be as per the machine size and length as per the Bio-compost yard	-
6.	On completion of laying & dressing of windrows, initial turning started to reduce moisture content from 70±5 % to 50±5 %. Time required for achieving desired moisture level, in summers 3 to 5 days, winters 4 to 7 days.	4 th -8 th days
7.	On achieving 50± 5 % moisture , bio culture (as a seed) in windrows added and turning of windrow started for proper mixing of culture seed and allow to increase windrow's temperature at around 70 °C.	
8.	Prepared windrows left idle for 2-3 days to proper growth of microbes.	8 th to 10 th day
9.	Growth/ development of microbes in windrows is observed by measuring its temperature. In normal condition temperature of windrows are between 60-70°. This temperature gain is result of microbial activity.	-
10.	When desired temperature achieved (within 2-3 days), start turning of press mud through aero tiller machines without any major deviation in shape & size of windrows.	
11.	Measure temperature manually with the help of thermometer.	
12.	Receive concentrated effluent from plant or lagoon at the bio compost yard through flow meter.	
13.	Spray concentrated spent wash not more than 10% of press mud weight on alternate days using the aero tiller or on suitable interval based on windrow	

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	temperature & moisture content. (The overall consumption of concentrated spent wash shall be 1.6 m ³ /MT of Press Mud). Alternatively spent wash can be sprayed on the basis of moisture content i.e. spraying can take place when moisture content has come down to 45 to 50% so as to increase moisture content to about 65 to 70%. During active Bio composting process the moisture will tend to go down because of heat generation.	
14.	During turning & spraying of effluent, monitor the windrow's temperature on daily basis and note in the log book. The quantity of sprayed effluent must be noted down in the log book.	
15.	Concentrated spent wash and turning of windrows continues for 50-60 days or till the windrows temperature up to 55± 5°C maintained.	10 th to 50 th day
16.	If no temperature rise is observed, then stop the concentrated spent wash spray on windrows and continue the turning of bio-compost till moisture content reaches 35±5 %	50 th to 60 th
17.	Store the prepared bio-compost under covered condition during rainy season	
18.	Bio-compost shall be analyzed for parameters as per the Fertilizer Control order with latest amendments and shall be packed as per the customer requirement.	
19.	Personal Protective Equipment (PPE) as per job requirement shall be used by personnel working in the bio -compost yard.	
20.	Check the top level of concentrated spent wash storage lagoon on daily basis so as to maintain below Red mark.	

NB: Requirement of Pressmud depends on the size of aerotilling machines which are available in different sizes and also with side mounted turner and top mounted turning equipment. Further, the windrows require dressing with JCB machine after every turning for which a spacing of about 3.0 meters is required between each windrow.

Specification of covered Bio-compost yard for Distillery operating throughout year

- Yard Length:** depending upon plot size available covered yard shall be made after leaving proper circulation area for movement of machinery; on an average 15-20% area may be allocated depending on the shape of the yard, e.g., square or rectangular yard may need the minimum circulation area where as stepped yard have the different windrow length need more circulation area.
- Windrow markers** indicating windrow number, date of formation, date of inoculation and date of the last application of spent wash. Marker shall be made of MS sheet with rod support, grouted in concrete. Marker shall be painted with white background and letters in black paint.
The windrow marker should be located in front of windrow after leaving the distance of movement of machines.
- Bays:** Approximately 12.0 meter span, having spacing between vertical columns 5-6 meters, rain water gutter height 6.2 meter, gutter slope of minimum 1 in 200. Gutter MoC HDPE / PE/ GI sheet, discharging into RCC / Cement Plastered Brick masonry channels connected to leachate collection pits. In case of multiple down-comers slope is not mandatory. Ridge height will vary upon truss design. Truss design may have provision of ventilation at the top (North light pattern) or semi elliptical.
- Down comers for rain water:** Compost shed shall be provided with Rain gutters and the rain gutters shall be connected to the storm water drain using HDPE/PE pipe of at least 150 mm ID down-comers discharging into channel. Channel MoC RCC (M20)/brick masonry cement mortar plastered (1:6) discharging to either rainwater harvesting pit or to natural stream.
- Protection against cross wind rain:** Rain water entry into the shed shall be prevented by either providing protection along the sides or by providing Louvers.
- Leachate collection pits:** MoC- RCC (M20) / brick work cement mortar plastered (1:6). Size: not less than 1.5 meter X 1.5 meter having top level / free board 300 mm above the ground level.
- Leachate collection drain:** MoC- RCC (M20)/brick work cement mortar plastered (1:6). Size: 0.3 meter (width) X 0.25 (depth). The depth will increase along the length towards collection pit. Bed slope: 1 in 200 approx with smooth finishing to prevent sludge (press mud) deposition on the base.
- Truss members:** Members size (Diameter, wall thickness) depending on the safe structural design capable to with stand against design wind load and rainfall. Material of construction shall be preferably GI pipes/ Galvanized angles /channel sections / RCC columns. Pre-engineered profiles may also be used. The GI pipes/ channels should be grouted in concrete in the bio compost yard

floor and should be protected by providing concrete cover of at least 150 mm all-round, at least 300 mm height to prevent corrosion due to direct contact on the base.

9. **Roofing:** Poly film minimum 200 micron film with qualities of UV stability, anti-drip, anti-dust, Light Diffusion minimum 50% film fixing only on roof and gables and up to hockey purlin / GI sheet / Precoated laminated sheet
10. **Floor lining:** The floor lining shall be impervious, strong enough to prevent settlements due to machine load. Minimum thickness 100 mm. The underlining sheet shall be minimum 150 micron HDPE film below the floor. Clay layer cushion of 300 mm below the liner and 50 mm above the liner should be provided. In case of RCC flooring, the construction joint should be sealed using the water bar/hot bitumen.
11. **Ground water monitoring facilities.**
 - a. **Location of piezometer wells:** Minimum at 4 places along the periphery of the bio-compost yard such that one is in the upstream of the Ground water flow direction and one in the downstream direction. For Bio-compost yard of more than 5 acres area, one additional peizowell shall be constructed for every 5 acres and shall be in the downstream direction placed sufficient away from each other to assess any seepage /ground water contamination tested quarterly. (Example: for 20 acre Bio-compost yard the total number of Peizowells shall be $4+3=7$ nos. One upstream and 6 down steam uniformly distributed). Piezo-wells shall be constructed as per the standard procedure and specifications.
 - b. **Hand pump:** at least 30 meters depth, located within 500 meters to 1 Km from yards. Water quality of hand pump should be tested quarterly.
12. **Data recording:** Log book at yard should be maintained mentioning the date of formation of windrow, quantity of press mud, feed stock, date of last aero-trilling, date of last spent wash spray, quantity of spent wash spray, temperature date-wise, date of maturity, moisture content etc. Data should also be entered into the computer for record and computation. The press mud and ready compost must be weighed and records of the same shall be maintained.
13. **Approach Road to bio-compost yard:** The entrance of the Bio-compost yard should be paved all-weather road for approach of vehicles.
14. **Storage facilities for ready compost:** Covered shed having platform.
15. **Camera** as per OCEMS guidelines shall be installed in the bio-compost yard to monitor the bio-compost operations inside the shed.

Specification of Bio-compost yard for Distillery operating 270 days (excluding rainy season)

1. **Yard Length:** depending upon plot size available yard shall be made after leaving proper circulation area for movement of machinery; on an average 15-20% area may be allocated depending on the shape of the yard, e.g., square or rectangular yard may need the minimum circulation area where as stepped yard have the different windrow length need more circulation area.
2. **Windrow markers** indicating windrow number, date of formation, date of inoculation and date of the last application of spent wash. Marker shall be made of MS sheet with rod support, grouted in concrete. Marker shall be painted with white background and letters in black paint.
The windrow marker should be located in front of windrow after leaving the distance of movement of machines.
3. **Leachate collection pits:** MoC- RCC (M20) / brick work cement mortar plastered (1:6). Size: not less than 1.5 meter X 1.5 meter having top level / free board 300 mm above the ground level.
4. **Leachate collection drain:** MoC- RCC (M20)/brick work cement mortar plastered (1:6). Size: 0.3 meter (width) X 0.25 (depth). The depth will increase along the length towards collection pit. Bed slope: 1 in 200 approx with smooth finishing to prevent sludge (press mud) deposition on the base.
5. **Floor lining:** The floor lining shall be impervious, strong enough to prevent settlements due to machine load. Minimum thickness 100 mm. The underlining sheet shall be minimum 150 micron HDPE film below the floor. Clay layer cushion of 300 mm below the liner and 50 mm above the liner should be provided. In case of RCC flooring, the construction joint should be sealed using the water bar/hot bitumen.
6. **Ground water monitoring facilities.**
 - c. **Location of piezometer wells:** Minimum at 4 places along the periphery of the bio-compost yard such that one is in the upstream of the Ground water flow direction and one in the downstream direction. For Bio-compost yard of more than 5 acres area, one additional peizowell shall be constructed for every 5 acres and shall be in the downstream direction placed sufficient away from each other to assess any seepage /ground water contamination tested quarterly. (Example: for 20 acre Bio-compost yard the total number of Peizowells shall be 4+ 3 =7nos. One upstream and 6 down steam uniformly distributed). Piezo-wells shall be constructed as per the standard procedure and specifications.
 - d. **Hand pump:** at least 30 meters depth, located within 500 meters to 1 Km from yards. Water quality of hand pump should be tested quarterly.

7. **Data recording:** Log book at yard should be maintained mentioning the date of formation of windrow, quantity of press mud, feed stock, date of last aero-trilling, date of last spent wash spray, quantity of spent wash spray, temperature date-wise, date of maturity, moisture content etc. Data should also be entered into the computer for record and computation. The press mud and ready compost must be weighed and records of the same shall be maintained.
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Biocompost area calculation:

The requirement of Pressmud depends on the size of the aerotilling machine that comes in varying dimensions. Also, aerotilling machines come with side mounted turner and top mounted turning machine. Further, the windrows require dressing with JCB machine after every turning for which a spacing of 3 mtrs is required between each windrow.

The area of biocompost area required shall be calculated based on the following sample basis of calculation

License capacity of distillery – 36000 KL/Annum

Spent Wash generation – 9 KL/KL

Total Spent Wash = 324000 KL

Concentrated Spent Wash@60% vol reduction = 129600 KL/Annum

Pressmud Requirement@1.6 MT/KL = $129600/1.6 = 81000$ MT

The land requirement for pressmud should therefore be designed based on the windrow size following the sample calculation as below based on 850 MT/Acre/cycle of pressmud

No. of Cycle = 4

Pressmud/Cycle = $81000/4 = 20250$ MT

Land Area Required = $20250 / 850 = 23.8$ Acres

No. of Cycle = 5

Pressmud/Cycle = $81000/5 = 16200$ MT

Land Area Required = $16200 / 850 = 19.0$ Acres

In case of specially designed aerotiller machine, bio-compost yard area will be calculated as per the windrow size specification mentioned by the machine manufacturer.