...ation velocity : Q_e/A (m/min).

...tration time → t_f

for con

Capacity = V_G/time

Cleaning of Bag House ~~mechanism~~ →
i) Mechanical shaking
ii) pulse - Jet Bag filter
(iii) Reverse jet Bag filter.

t_f - time of filtration
t_c : time of Cleaning.

Maximum capacity - $\frac{V_G}{t_f}$

$\boxed{t_c = 0 \text{ for max}^m \text{ capacity}}$.

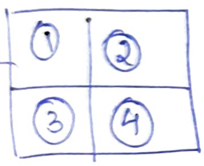
Overall capacity = $\frac{V_G}{t_f + t_c}$.

for optimum capacity for design purpose $t_f = t_c$.

→ Sizing of Bag.
no bag should be more than 3-4 m.
typical diameter 40-50 cm

Guideline for Bag filter ~~area in m2~~

Area in (m^2)	No of compartment
1-200	1-2
201-600	3-4
601-1000	5-7
1001-1600	8-10
1601-2200	11-13
2201-3000	14-16
3001-4100	17-20
> 4100	> 20



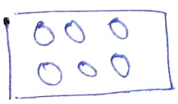
1, 3, 4, → working.

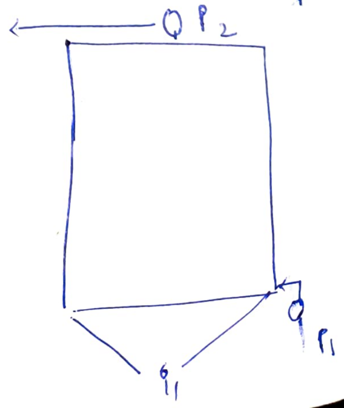
Minimum pressure drop - 30-40 cm of water column.
Maximum pressure drop - 150 cm of water column.
Cake is form in Bag filter - known by high pressure drop
Choking of bag filter. rupture of Bag filter.

If pressure drop - 3-4 cm of water column.

→ If rupture of Bag - replace the chocked or rupture Bag.

N = No of Bag.





Constant rate filtration :-

$$\Delta P = B Q_t^2 + CQ$$

at $t = 0$ $\qquad \Delta P = CQ$

$t = t$ $\qquad \Delta P = BQ^2 t + CQ$

$$Q = \frac{V_G}{t}.$$

$t_f =$

rupture of bag (i) chocking of Bag
(ii) huge quantity of.

$$\text{Air to cloth Ratio} = \frac{Q}{\text{total filtration Area of Bag house}}.$$

1.2 to 2.5 m/min for pulse-Jet Bag filter.

If the Air to cloth ratio is very small → Almost nothing.

Maxm temp a bag filter withstand is 280°c by

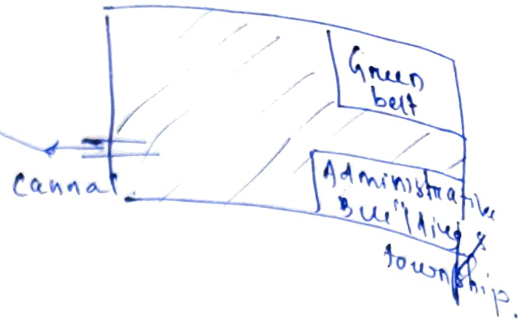
Properties of ~~filter media~~ :- Bag filter fiber materials :-

fibre :-	strength	maxm tempr	Remarks :	
(1) Cotton	strong	80	low cost	Not suitable for acidic dusts.
(2) Nylon	strong	100	easy to clean	excellent for Abrasive material.
(3) Polyester	strong	135	easy to clean.	
(4) Teflon	medium	260.	Expensive.	
(5) Glass fiber	strong	280	poor resistance to abrasive.	
Women Nylon.	strong	230	poor resistance to moisture.	

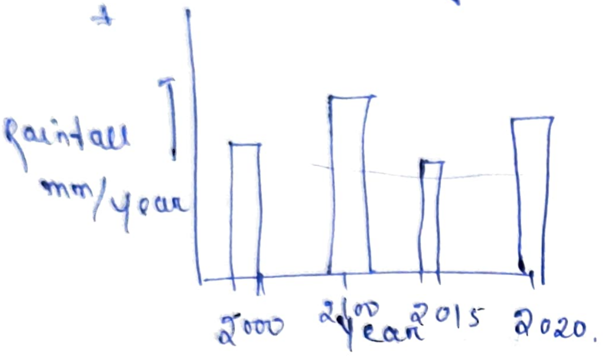
IPC class 13 oct 2025 :-

Surface runoff management :-

$\boxed{\text{ETP}}$



Zero liquid discharge



$$\text{Average rainfall} = \frac{\Sigma h_i}{\Sigma \text{year}}$$

$$Q_s = \underset{(m^2)}{\text{Area}} \times \underset{(m)}{h} \times \text{Coefficient.}$$

water demand $= Q_D - Q_T - Q_s$

$ETP = 200 m^3/hr.$

$Q_D = 4000 m^3/hr.$

$\downarrow$

$50 m^3/hr$

Type	Area
T_1	A_1
T_2	A_2
T_3	A_3
$\vdots$	$\vdots$
T_n	$\vdots$

$\Sigma A_i = \text{Area}.$

Surface run off calculation:-

Rational Method

$$Q = C \times i \times A$$

Q = Peak ~~ko~~ Rate of Runoff m^3/day

C = Run off coefficient

i = Av. intensity of Rainfall in mm/day.

A = water shed Area in Acere.

$$C_{eq} = \frac{A_1 C_1 + A_2 C_2 + A_3 C_3 + \cdots}{A_1 + A_2 + A_3 + \cdots}$$

$A_1, A_2, A_3 \ldots$ the area of different land type.

$C_1 C_2 C_3$: corresponding run off coefficient for these land type.

This weighted average approach ensure that the varied soil cover condition are accurately represented in the run off calculation.

Example.

surface description	C-value
Asphalt and concrete	0.70 - 0.95
Roof	0.75 - 0.95
woodland	0.05 - 0.25
sandy soil, flat	0.05 - 0.10
heavy soil, flat	0.13 - 0.17.

Total rainfall on yearly basis:-

Year	Rainfall mm
April 2019 - March 2020	1989
April 2020 - March 2021	1920.
April 2021 - March 2022	2287.
April 2022 - March 2023	1575.

April 2013 - march 2021 - 112

Total 8894

Average 1179 → i value

Yes

i = 1222 mm

1.2 m

Mitigation Measures :-

* Pond sizing Based on Peak discharge :- The calculated Peak discharge during monsoon month helps to determine the required volume of ponds or reservoir.

Q

An old Bag filter from a discontinue process is to be utilized for constant pressure filtration at 12.7 cm of water column the bag house was 20 bags of 7432.24 cm² each. cleaning time of bag is determined as 45 mins. for the given pressure filtration the following expression can be used

$t = 674.82\, V_g^2$

t = time, min

V_g - volume of gas filter. (m^3/cm^2)

determine the maximum capacity of the bag house & overall capacity of bag house under the given condn.

Maximum capacity = V_g / t_f

$t_f = t_c$ =

~~total surface area~~ =

total surface area = 7432.24×20

$= \underline{148644.}\ cm^2$

$t = 674.82\, V_4^2 = \cancel{14.86\, m^2}$

$45\,min = 674.82\, V_4^2$

$V_4 = 0.258\ \cancel{min}\ m^3/cm^2$

maxm capacity $= V_4/t_f = \dfrac{38350\ m^3}{45\ min}$

$= 51133.81\ m^3/hr$

$= \cancel{0.258}\ \cancel{14.86}$

$\cancel{3.83}\ m^3$

$t_f = 45\ min$

$= 38350\ m^3$

overall capacity :-

$V_4/t_f + t_c = \dfrac{38350.358\ m^3}{90\ min}$

$t_f + t_c = 90\ min$

$= 25566.90\ m^3/hr$

Q) A filter is operating at constant rate on an optimum cycle. The filtration equation is given as

$$V_4^2 = 2.623 \times 10^6 \times t \times p^{0.65}$$

p = cm of water column

V_4 = m3 of gas filtered.

t = time of filtration, in min.

The filtration time is 45 mins and cleaning time is 8 min the maximum allowable Pressure is 10.16 cm of H_2O colm.

calculate i) max^m overall capacity of bag house

ii) It is necessary to increase the capacity of bag house it has been suggested that an additional unit identical to the present one to be installed. both bag filter would work from the same IB fan ~~induced~~ which has ample capacity and the filtration to be carried out at the same max^m pressure as at present. The time required to save and clean two bag houses is estimated as 4 min. What is the % increase in the overall capacity that could be attained by adapting this cond^n.

$$\text{Max}^m \text{ capacity} = V_4 / t_f$$

$$=$$

$$V_4^2 = 2.623 \times 10^6 \times t \times P^{0.65}$$

$$= 2.623 \times 10^6 \times 45 \text{ min}/60 \times 10.16^{0.65}$$

$$V_4^2 =$$

$$\Rightarrow V_4 = 23080.534 \text{ m}^3$$

$$\text{max}^m \text{ capacity} = \frac{23080.53 \text{ m}^3}{45/60 \text{ hr}}$$

$$= 30774.04 \text{ m}^3/\text{hr}$$

$$\text{overall capacity} = \frac{23080.53}{45+8/60} = 26128.909 \text{ m}^3/\text{hr}$$

Q1

$\frac{Q_2 - Q_1}{Q_1} \times 100$

Overall capacity of two bag:

$\frac{2 \times 23080.534}{45+4/60}$ $56523.756\ m^3/hr.$

$= \cancel{28261.87\ m^3/hr}$

% increase $= \frac{56523.756 - 26128.909}{26128.909} \times 100$

$= \underline{116.32\ \%}$

Q A bag house is to constructed using bags of 30cm in diameter and 6 m long. The ~~bag~~ gas enter the bag house and 36 000 m3/hr has been determined 2 m/min The filter in velocity

calculate no of bag required for a continious operation of bag house.

Area of bag $= \frac{600cm \times 30cm}{}$ $= 18000\ cm^2$ $= 1.8\ m^2$

~~Filtration velocity = 2m/min~~

Filtratin velocity = 2m/min =

The gas enter: 36000 m3/hr

$\Rightarrow \frac{36000\ m^3/hr}{2\ m/1min/60hr} = \frac{36000\ m^3/hr}{2 \times 60\ m/hr}$

$= \frac{36000}{120}$ (300)

$= 300\ m^2$

Area of bag = $\frac{\pi}{4}D^2 + \pi \times 0.3 \times 6$

=

Waste water :- 21oct

IPC — Wet - Scrubbers (control of particulate & Gaseous pollutant).

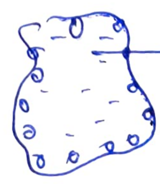
SO_2 HCl
NH_3 Acid mist
H/c
CO
H_2S

} not used ESP or baghouse.
Gravity settling chamber
cyclone

Adsorber
Adsorption (wet scrubber).

Gasious pollutants

- Adsorption
- Absorption
- Condensation
- Combustion.



Adsorbent

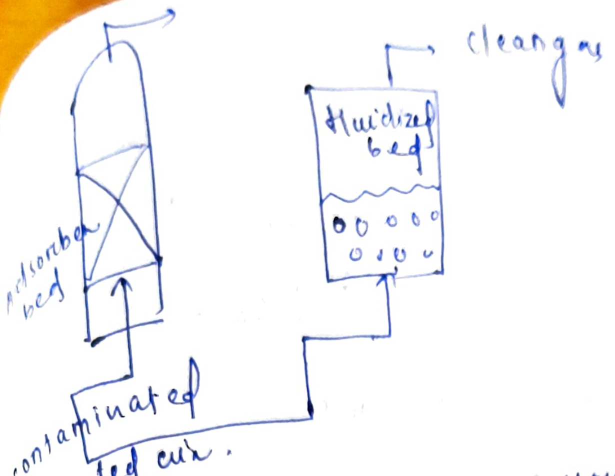
micro/macro pores

Specific surface Area, Adsorbent

m^2/gm of Adsorbent

Adsorption capacity

mg/gm of Adsorbent.



$SO_2 + H_2O \longrightarrow$ compound
& solvent.

wet scrubber

→ Transfer pollutant from air to water
→ further treatment may be necessary.
→ pollutant must be highly soluble in water.
→ for less soluble material, a chemical may be added to water
→ SO_2 may be removed by reacting with lime stn.

⇒

Air pollution control gases and vapors.
SOx. NOx, VOCs, HAPs, CO

⇒ slides

wet scrubbers Advantages / Disadvantages.

wet collectors

Bag filter problem

Q. It is required to remove the dust from an iron ore grinding count separation mill. The gas flows from the mill at 45 °C, rate 31680 m^3/hr. The gas filtering velocity 1.5 m/min determine the cloth Area required to process if the diameter of bag is

20cm and length is 5m how many bag will be required for continous cleaning of bagfn mill.

please

flow rate (Q) = 31680 m^3/hr

$= 31680/60 =$

filtrating velocity = 1.5 m/min.

Diameter of bag = 20cm = 0.2m.

length = (l) 5m.

~~total clot~~

$Q/A_c = V$

total cloth Area $\Rightarrow A_c = Q/v = \dfrac{528\ m^3/min}{1.5\ m/min}$

$\boxed{A_c = 352\ m^2}$

$A_c = N \times \left(\pi \times D \times l + \frac{\pi}{4} D^2\right)$

$352 = N \times \left(3.14 \times 0.2 \times 5 \times + \frac{3.14}{4} (0.2)^2\right)$

$N = 110.9$ bags

$= 111$ bags

Ramesh lord shiva

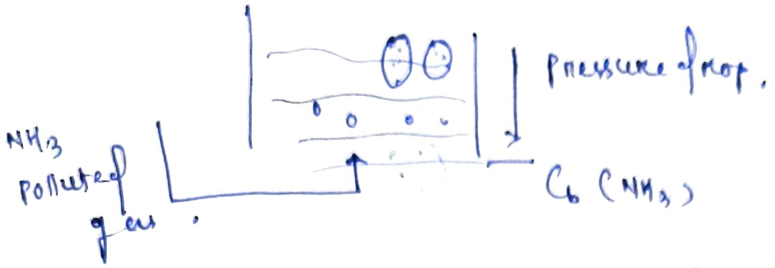
growth of mice, ganse consumed

single

Movie

sechelu

Removal = $K_{overall}$ ($C_b - C_i$)

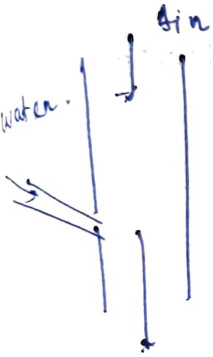


C_i - final conc h.

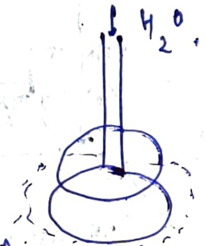
~~Removal = Koverall ($C_b - C_i$)~~ $= k_l\, a\, (\Delta C)$

a = interfacial area of contact.

$a = (m^2/m^3)$



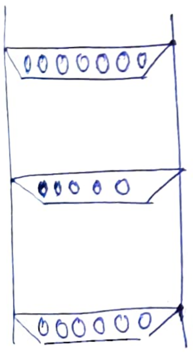
by changing a we can change the scrubber.



Sandhya
rc

Rotating plate droplet generator.

spray tower - η% 70-78%. low
but pressure drop is ~~high~~
so useful.



cyclonic scrubber.

[illegible] ?

Air scrubber Dt:- 28/10/25

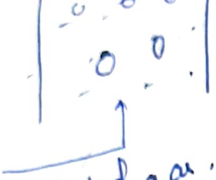
photos

particulate (photos)

Design the wet scrubber!

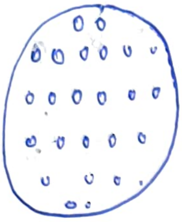
spray tower (photo sujeeta)

droplet size distribution - spray tower.



Polluted gas.

plate tower (photo)

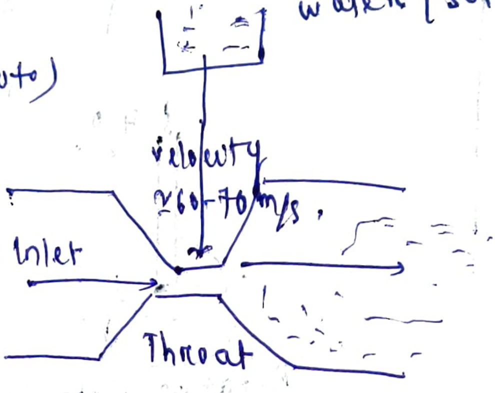


not used for industrial purpose.

75 um

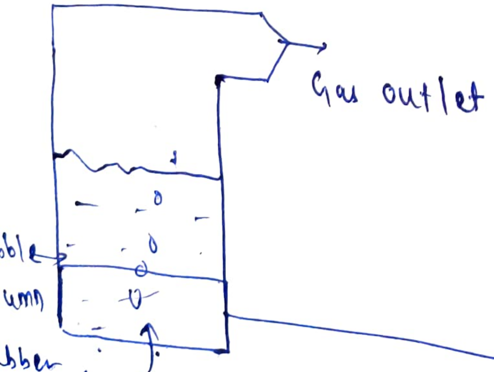
water / solution,

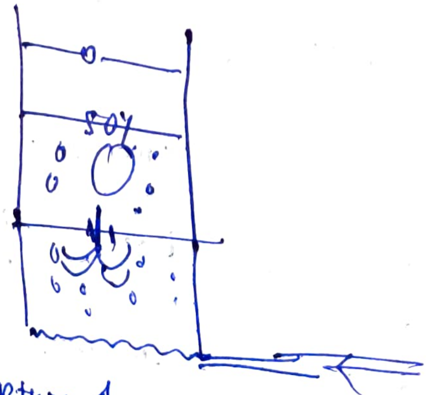
Venturi scrubber (photo)



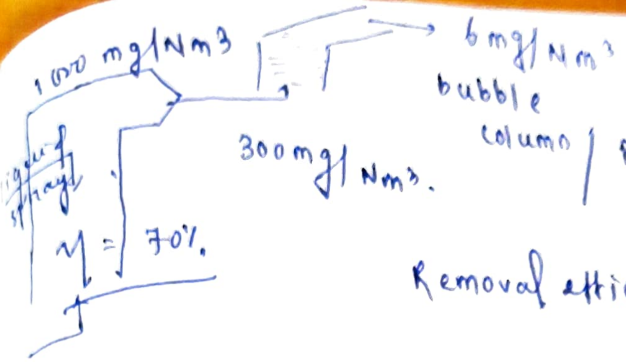
Packed tower.
spray tower.
1. working principle of all
2. design- packed, spray, plate
3. You develop design problem yourself.

Handbook by perry





Air/gas

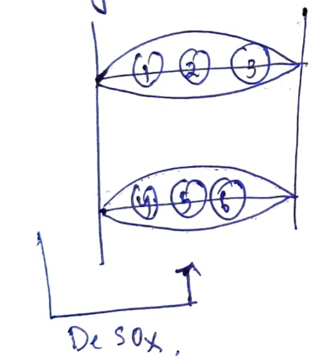


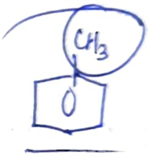
20 time

Removal efficien $= \frac{1000-6}{1000} \times 100$.

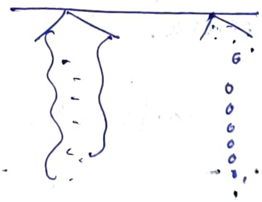
Q A sulphuric acid manufacturing plant emitting SO_2 Exhaust stream of the plant contain mainly SO_2 about 15%. by volume and carrier gas.

Monday 2.11.25. Scrubber :-



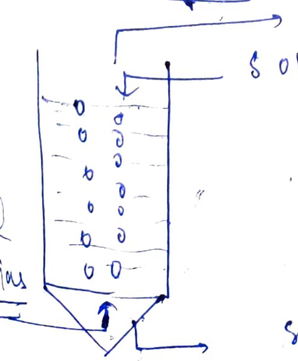


Type of nozzle



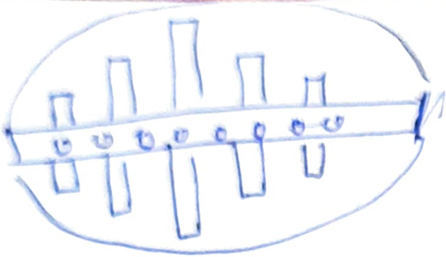
Scrubber Nozzles:-

Design :-



$Q = m^3/hr$

Large ... less



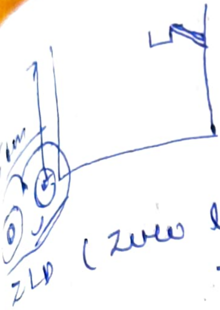
oxygen deficiency

Q. A bag house is operating at a constant gas rate for 30 min during which 78.8 m3 of gas from a cement mill operation is processed. The initial & final pressure drop of the unit is 10.16 mm of water column & 101.6 mm of water column respectively. If the filter is further operated for 1 hr at the final pressure calculate the quantity of additional gas which can be treated by this unit.

Q = ∴ ar + m –

Activated carbon filter

Rasmita Pujakari



ZLD (Zero liquid discharge)

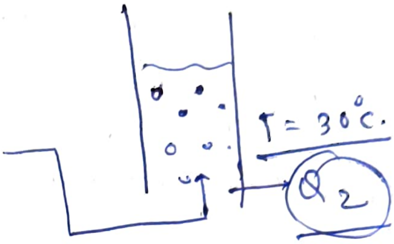
IPC

Dt:- 4.Nov 25

Q1

T = ? 300°c

P = ? 0.2 Atm(g)



T = 30°c.

Q2

$$\Delta Q = M_1 C_{P_1} (\Delta T)_1$$
$$= M_2 C_{P_2} (\Delta T)_2$$

$T_{new} = 35°c$

Q. A fertilizer plant emits 2 lakh m^3/hr of gases at 100°c and 0.06 atm gas pressure containing Ammonia with an inlet concn of 700 ug/m3. It is proposed to use a packed tower with water as an absorbing liquid. The industry needs to bring down the ammonia concn below 10 ug/m3. The eqm relationship is as follows

y_{NH_3}	0	0.016	0.024	0.032	0.04
x_{NH_3}	0	0.020	0.031	0.040	0.05

~~0.033~~	
~~0.040~~	

Q = 200000 m^3/hr.

T_1 = 100°c.

P = 0.06 atm

C = 700 ug/m3

Bag filter

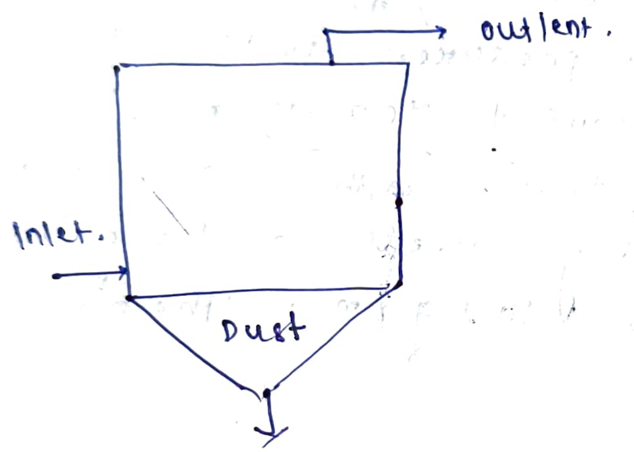
A Bag filter is used to treat 50 m^3/sec of waste gas stream. The Bag house to be divided in to 8 section of equal cloth area so that one section can be taken off for shut down for cleaning & maintainance & other remaining in working cond^n. The air to cloth area ratio $9\ m^3/min/m^2$ is used which provide sufficient surface area for the cleaning of the flow gas.

The Bags are 25 cm diameter & 7 m long. Calculate the no of Bags & physical arrangement required ~~for~~ to ~~abov.~~ meet the above requirem.

→ 8 section.

→ 7 used & one used by stand by mode

$Q = 50\ m^3/sec$



Q An old Bag filter from a discontinued process is to be utilised for constant pressure filtration at 120 mm of water. The filter has 40 Bags of 6 000 cm^2 each & filtratm. The filtration time is given as 50 min

eq^n is $t_f = 674.85\ V_f^2$

where V_f = volume of gas filtered per unit area in m^3/sec^2

t = time in min

calculate overall capacity of the bag filter under given cond^n

ii) max^m overall capacity

iii) If another three additional identical old Bag houses are installed to increase the capacity what is max^m % increase in the overall capacity for new arrangem
Assume total cleaning time with new arrangement is 20 min.

Susmi