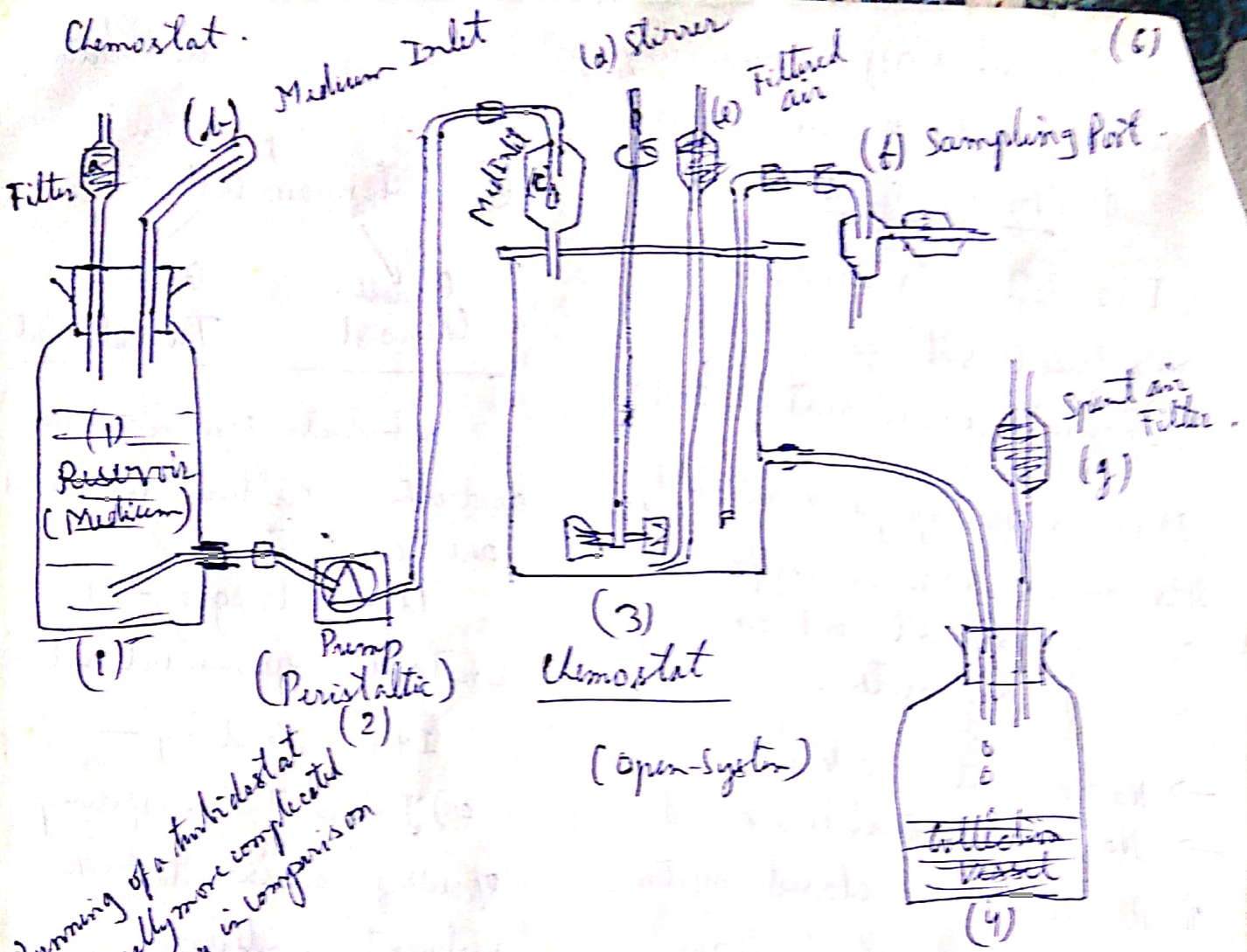
Chemostat.



Running of a turbidostat is technically more complicated and demanding in comparison to chemostat.

Supply nutrient medium at a constant rate
Forced aeration and mechanical stirring to ensure optimal oxygen supply and equal distribution of nutrient throughout culture.

⟹ Let
Volume of Culture vessel is V. litre.
Rate of Medium supply (f) = (l/h)
Then dilution rate is D = f/V = Volume change per hr
D = Volume change per hour.
Initial no. of Bact. cells x = g/l were unable to grow. They would be washed out of culture vessel with a wash out rate

$$D \cdot X = \frac{dx}{dt}$$

CONTINUOUS CULTURE

In this type of culture substrate concentrations and other cultural condition are kept constant,

Cells grow at a constant exponential rate.

This can be achieved by frequent transfering of cell population to fresh nutrient medium

The reverse is simple i.e.

Addition of new medium to a growing cell population and withdrawal of equal volumes of bacterial culture.

It may be carried out in chemostat or turbidostat.

Fig: Chemostat

→ There is exponential decrease in bacterial cell concentration

$x = x_0 \cdot e^{-Dt}$.

⇒ There is also exponential increase in bacterial cell in culture vessel

Rate of increase = $\mu x = \frac{dx}{dt}$

$\Rightarrow x = x_0 \cdot e^{-\mu t}$

⇒ Hence Inside the culture vessel the rate of change in bacterial cell concentration depends upon these two.

→ Removal & growth.

i.e. $\frac{dx}{dt} = \mu x - Dx$.

If μ & D are equal (μ = growth rate, D = dilution rate).

Then bacterial gain and loss by washout are in balance. (by growth)

Hence change in bacterial mass is zero.

or There is constant bacterial concentration.

& the culture is in constant or Steady state

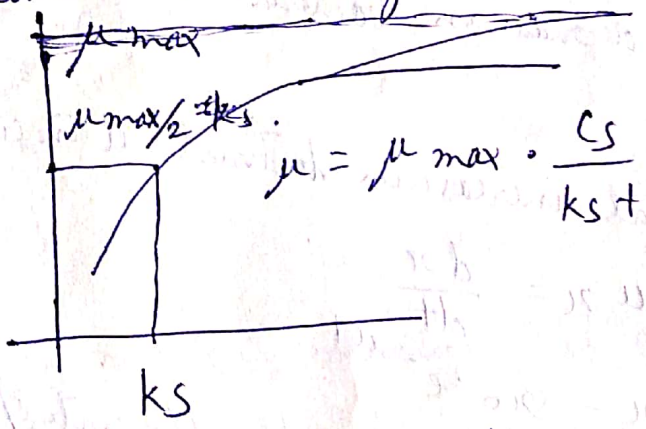
Growth limiting substrate (Hydrogen donor, N, S, or P source) are controlled & they controle the concentration of Medium.

The substrate limitation may be used to keep the actual growth constant μ less than the ~~possible maximum~~ maximal growth constant possible at the substrate concentration μ_{max}.

The dilution rate D can be varied over a wide range without risk of wash out.

Here, The dilution rate must not excud μ_{max}.

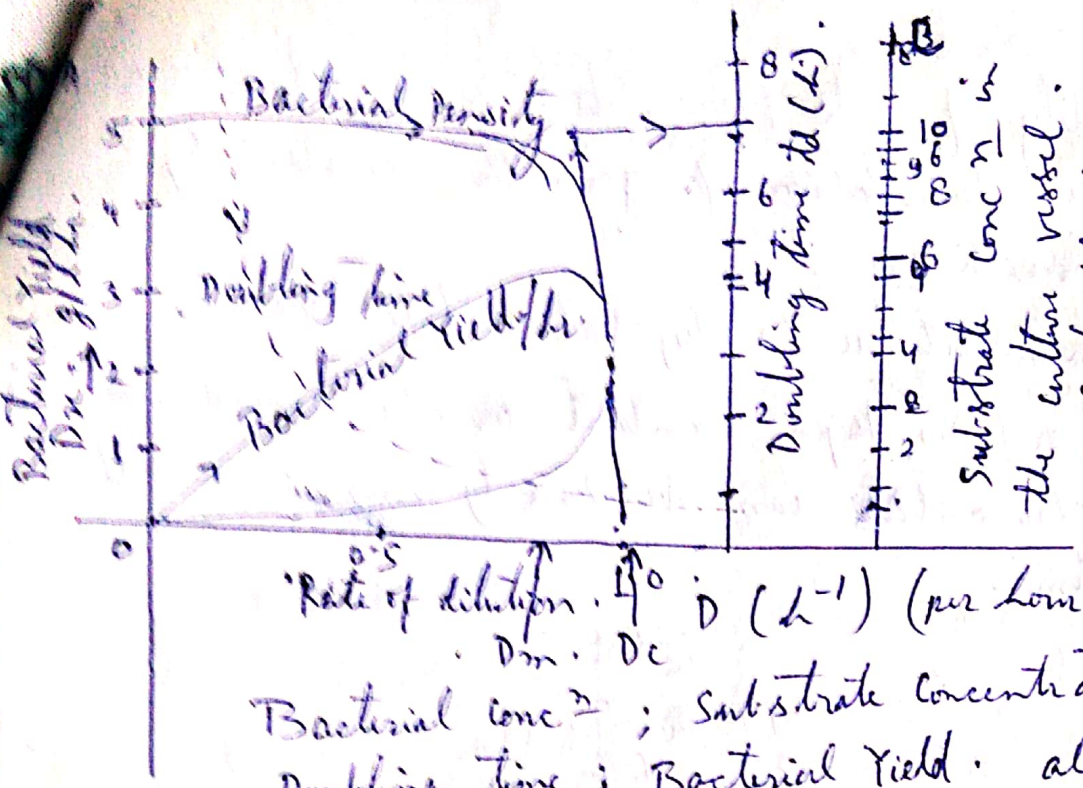
The dependence of growth constant μ on the substrate concentration C_s gives a saturation curve.



Generally bacteria can grow at a low s/substrate concentration (10mg glucose/l medium), at maximal rate.

$\mu \propto C_s$ at which, $\mu = \frac{1}{2} \mu_{max}$.

K_S is one of the fundamental growth parameters of a constant culture, together with Y (yield) and μ_{max}.



Dm = Rate of dilution for max Yield.

Dc = Wash out point.

Bacterial conc^n ; Substrate Concentration ; Doubling time ; Bacterial Yield. all plotted against the dilution Rate D.

Bacteri

When the dilution rate vary from zero (0) and Wash out rate Dc.

There is no variation (little) in the bacterial conc^n.

In this range bacteria respond to increase in dilution rate with decrease in doubling time, increase in growth rate

The increasing dilution rate and similarly increasing medium flow rate with decreasing doubling time, however produce ~~and~~ an increasing expulsion of bacteria

It reaches a maximum ~~rate~~ at a dilution Dm.

After it (Dm) it decreases rapidly.