



1 A bioreactor



Industrial fermenters

- ❑ Can hold up to 200 000 litres of culture
- ❑ Cells are provided with nutrients and very carefully controlled environment to keep them in desired growth stage
- ❑ Usually made out of stainless steel as many fermentations produce acid.
- ❑ Nutrients and other materials are fed in by valve operated pipelines.

Industrial fermenters





Industrial fermenters

- Conditions in the fermenter are carefully monitored to regulate cell growth.
- Fermenter and all pipework must be sterile before fermentation begins
- This is usually achieved by flushing the whole system with superheated steam before the production begins.



Industrial fermenters

- Interior is monitored by sterilisable **probes** which record temp., pressure, stirrer speed, pH, oxygen and carbon dioxide levels.
- These are all recorded and electronic control systems with automatic valves will regulate them.
- E.g. if medium becomes too acidic, bases can be added from a reservoir to correct the pH

Industrial fermenters



- A fermenter with a 30 000 gallon capacity



Industrial fermenters

- The production of microbial products is called fermentation but it is not fermentation in the defined sense of the word.
- Process is frequently aerobic so fermenter has to be well aerated.
- Incoming air is filtered and pumped into the base of the fermenter – a valve releases the pressure from the top of the tank.



Industrial fermenters

- ❑ An antibiotic producing fermentation may use a tonne of sugar a day.
- ❑ The organisms are likely to raise the temperature of the culture by more than 1⁰C per hour ; more heat will come from the activity of the impeller.
- ❑ This rise in temperature could quickly kill the microbes if not cooled.
- ❑ Cooling is achieved by either a water jacket or cooling coils inside the fermenter.



Industrial fermenters

- ❑ Most fermentations are batch processes, e.g. beer and wine, penicillin
- ❑ Nutrients and the inoculum are added to the sterile fermenter and left to get on with it!
- ❑ Anti-foaming agent may be added.
- ❑ Once the desired amount of product is present in the fermenter the contents are drained off and the product is extracted.