

Using batch and continuous cultures biology essay



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Microbial growing causes an addition in a micro-organism ' s size and population figure and can be studied utilizing batch and uninterrupted civilization mediums (Lansing M. Prescott et Al. 1990, 1993, p.

112)

Batch civilizations:

Alimentary ingestion and construct up of toxic byproducts slow down and halt the growing of bacteriums. One method to avoid this is to utilize batch civilization system. This involves culturing bacteriums in liquid medium within a closed system where no fresh medium is added during the incubation period and hence the alimentary concentration diminutions and waste merchandises accumulate during the growing of bacteriums (Slonczewski & A ; Foster 2009, p. 137) . The micro-organisms reproduce by binary fission and their growing can be expressed as the logarithm of cell figure and can be plotted against incubation clip.

This consequence in a curve that has 4 distinguishable stages as shown in Figure 1: (Lansing M. Prescott et Al. 1990, 1993, p. 113)Figure 1: Curve demoing stages of growing for batch civilizations (taken from Tortora et Al. 1992)Lag Phase- when micro-organisms are introduced into fresh civilization medium no addition in cell figure or mass occurs. This marks the beginning of the Lag Phase which is necessary as the cells may be old and depleted of ATP, certain indispensable cofactors and ribosome, the medium may be different from the 1 that the micro-organism was turning in antecedently, or the micro-organism may hold suffered hurts and may necessitate clip to retrieve (Lansing M. Prescott et Al. 1990, 1993, p.

113) . Length of the Lag Phase varies depending on factors such as age of civilization, temperature alterations and differences between old and new media. When cells are transferred from a complex medium to a fresh complex medium slowdown stage is really short, whereas when cells are transferred from complex medium into a minimally defined medium, lag stage is protracted (Slonczewski & A ; Foster 2009, p. 137) . Exponential Phase- during this phase the rate of growing of micro-organism is changeless and they divide and become dual in figure at regular intervals and at the maximum rate possible given their familial potency, nature of the medium and the conditions of growing (Lansing M. Prescott et Al.

1990, 1993, p. 113) . As batch civilizations are non synchronal every cell has an equal coevals clip and each cell divides at a different minute, as hence the cell figure rises swimmingly. When the medium is suddenly changed nutritional downshifts or nutritional upshifts cause cells sing balanced exponential growing to be thrown into metabolic pandemonium that is imbalanced growing (Slonczewski & A ; Foster 2009, p.

138) . Exponential stage civilizations are used in biochemical and physiological surveies as the population is most unvarying in footings of chemical and physiological features during this stage (Lansing M. Prescott et Al. 1990, 1993, p. 113) .

Stationary Phase- during this stage the growing curve becomes horizontal as growing of the population ceases. Bacteria enter this stage at a population degree of around cells per milliliter. The entire figure of feasible beings remains changeless due to a balance between cell division and cell decease

or because the population ceases to split but still remains metabolically active. Microbial populations enter the stationary stage due to grounds such as alimentary restrictions, O handiness and accretion of toxic waste merchandises (Lansing M. Prescott et Al. 1990, 1993, p. 114) . Death Phase-characteristic characteristic of this stage is diminution in the figure of feasible cells due to alimentary want and buildup of toxic wastes.

The decease of a microbic population is logarithmic. The drawn-out endurance of peculiarly immune cells may cut down the decease rate (Lansing M. Prescott et Al. 1990, 1993, p. 114) . In this stage the figure of cells that die during a given clip period is relative to the figure of cells that existed at the beginning of the clip period (Slonczewski & A ; Foster 2009, p. 138) .

Advantages of utilizing batch civilizations:

They allow versatility and can be used for many different reactions (Nielsen & A ; Villadsen 1994, p. 344) . They are safe and do non present a menace of strain mutant (Nielsen & A ; Villadsen 1994, p. 344) . They guarantee complete transition of substrate (Nielsen & A ; Villadsen 1994, p. 344) .

The altering conditions during the usage of batch civilizations affect the physiology and growing of bacteriums and therefore highlight the ability of bacteriums to accommodate to its environment (Slonczewski & A ; Foster 2009, p. 137) .

Disadvantages of utilizing batch civilizations:

Use of batch civilizations requires extremely skilled labour therefore increasing labour costs (Nielsen & A ; Villadsen 1994, p. 344) . Use of batch civilizations is clip devouring (Nielsen & A ; Villadsen 1994, p.

344) . Harmonizing to Xuezhen Kang (2000) altering concentrations of merchandises and reactants, changing pH and oxidation-reduction possible makes reading of consequences hard. Harmonizing to Xuezhen Kang (2000) complicated mix of turning, deceasing and dead cells besides makes reading hard.

Continuous civilizations:

In a uninterrupted civilization system the micro-organisms are grown in an unfastened system where changeless environmental conditions are maintained through uninterrupted commissariats for new foods and remotion of waste. This allows the microbic population to stay in exponential growing stage and at a changeless biomass concentration for an drawn-out period of clip (Lansing M.

Prescott et Al. 1990, 1993, p. 120) . 2 chief types of uninterrupted civilization systems: Chemostat- this system ensures that unfertile medium incorporating indispensable foods in restricting measures is fed into the civilization vas at the same rate as the medium incorporating the micro-organism is removed (Lansing M. Prescott et Al. 1990, 1993, p.

120) . The growing rate of micro-organism is determined by the rate at which new medium is fed into the growing chamber. The concluding cell denseness depends on the concentration of the confining food (Lansing M.

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Prescott et Al. 1990, 1993, p. 120) . Dilution rate “ D ” is used to show the rate of alimentary exchange and is defined as the rate at which medium flows through the civilization vas relation to the vas volume. “ f ” represents flow rate and “ V ” represents volume of the vas (Lansing M.

Prescott et Al. 1990, 1993, p. 120) .

$D = f/V$ degree Fahrenheit (ml/hr) and V (milliliter) (Lansing M. Prescott et al. 1990, 1993, p. 120) Microbial population degrees and coevals clip depend on the dilution rate. As the dilution rate additions coevals clip shortens and growing rate rises.

Under these conditions the restricting food will be about wholly low and it begins to lift at higher dilution rates as there are fewer microorganisms nowadays to utilize it. At low dilution rate a rise in both cell denseness and growing rate occur (Lansing M. Prescott et Al. 1990, 1993, p. 120) .

Turbidostat- involves a photoelectric cell that measures the turbidness of the civilization in the growing vas.

The rate of flow of the media through the growing vas is automatically regulated to keep a preset turbidness. Here the dilution rate remains changeless and there is no restricting food in the civilization. The turbidostat operates best at high rates of dilution (Lansing M. Prescott et Al. 1990, 1993, p.

120) .

Advantages of utilizing uninterrupted civilizations:

They allow good use of the bioreactor and guarantee low labour costs

(Nielsen & A ; Villadsen 1994, p. 344) .

They are efficient and guarantee high and changeless productiveness due

the autocatalytic nature of microbic reaction taking topographic point

(Nielsen & A ; Villadsen 1994, p. 344) . They allow elaborate analysis of

microbic physiology at different growing rates as all cells of the population

achieve a steady province and hence has important industrial and research

applications (Slonczewski & A ; Foster 2009, p. 139) . The state of affairs in

a chemostat resembles the growing of bacteriums in nature where the

growing rates are really low (Slonczewski & A ; Foster 2009, p. 140) .

Harmonizing to Xuezheng Kang (2000) their usage eliminates the slowdown

the being experiences before traveling into high productiveness.

Disadvantages of utilizing Continuous Cultures:

Sometimes they fail to bring forth consequences due to infection and

mutants of micro-organisms that result in production of non bring forthing

strains (Nielsen & A ; Villadsen 1994, p. 344) . Use of these civilizations

requires downstream equipments to be designed for low volumetric rates

and uninterrupted operation (Nielsen & A ; Villadsen 1994, p.

344) . In decision, we see that both civilization mediums have their

advantages and disadvantages and while utilizing either one, these should

be kept in head.