

A level Biology A
H420/03 Unified biology

Question Set 19

1 Bacteria and fungi can be used to make food for human consumption. The use of microorganisms in food production creates fewer ethical issues than the use of animals.

(a) (i)* Using examples, describe and explain some **other** advantages of using microorganisms to produce food for human consumption.

[6]

A: low cost

E: many microorganisms require only low temperatures & nutrients for growth are cheap

A: large numbers can be produced quickly

E: short generation time so reproduce quickly

A: can be produced in many locations

E: not affected by climate so easy to control conditions

A: suitable food for vegans & healthier food

E: low cholesterol & high in protein or fibre

EXAMPLES: - Brewer's yeast / for alcohol

- Baker's yeast / for bread

- Lactobacillus / for cheese or yoghurt

- fungal lactase / for lactose free milk

- Pectinase / from *A. niger* / fungus / for fruit juice

(ii) On an industrial scale, microorganisms can be cultured using either batch fermentation or continuous fermentation.

The table below lists statements about industrial culturing of microorganisms.

Place ticks (✓) in the table to indicate whether each statement applies to batch or continuous fermentation.

Statement	Batch	Continuous
Waste is removed during the fermentation process		✓
A fixed volume of nutrient medium is used	✓	
Secondary metabolites are more likely to be produced	✓	
The growth rate tends to be faster		✓
The culture is grown for a fixed period of time	✓	

[3]

- (b) (i) Serial dilutions can be used to estimate the size of a bacterial population in a culture.

A scientist used 20 cm^3 of a bacterial culture that contained 1.0×10^6 bacterial cells.

- 5% of the 20 cm^3 culture was transferred to a new test tube and made up to 10 cm^3 with water.
- An additional ten-fold dilution was carried out, which produced a final 10 cm^3 solution.
- 0.1 cm^3 of the final 10 cm^3 solution was transferred to an agar plate.

Each colony that developed on the agar plate was assumed to represent a single bacterial cell in the bacterial culture.

Estimate the number of colonies that you would expect to develop on the agar plate.

$$\begin{aligned} 1.0 \times 10^6 \times \frac{5}{100} &= 50000 & 5000 \times \frac{0.1}{10} &= 50 \\ \text{number of colonies} &= & & \\ 50000 \div 10 &= 5000 & & \end{aligned} \quad [3]$$

- (ii) A student carried out a different serial dilution to estimate the size of another bacterial population.

The serial dilution resulted in four colonies developing on an agar plate.

Explain why the student's estimation of this bacterial population is likely to be inaccurate.

with low colony numbers small random differences^[1]
in plating produce large errors when estimating

- (c) Some microorganisms can be used by humans in industry. Some microorganisms are pathogenic.

Pathogenic microorganisms are transmitted in various ways.

Complete the following passage about the transmission of pathogenic microorganisms using the most appropriate terms.

Some pathogens are carried between host organisms by animals, which are often insects.

These animals suffer no symptoms of the disease and are known as vectors

Other pathogens, such as *P. infestans* that causes potato blight, produce reproductive structures called spores, which can be carried on air currents to infect other hosts.

[2]

Total Marks for Question Set 19: 15

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