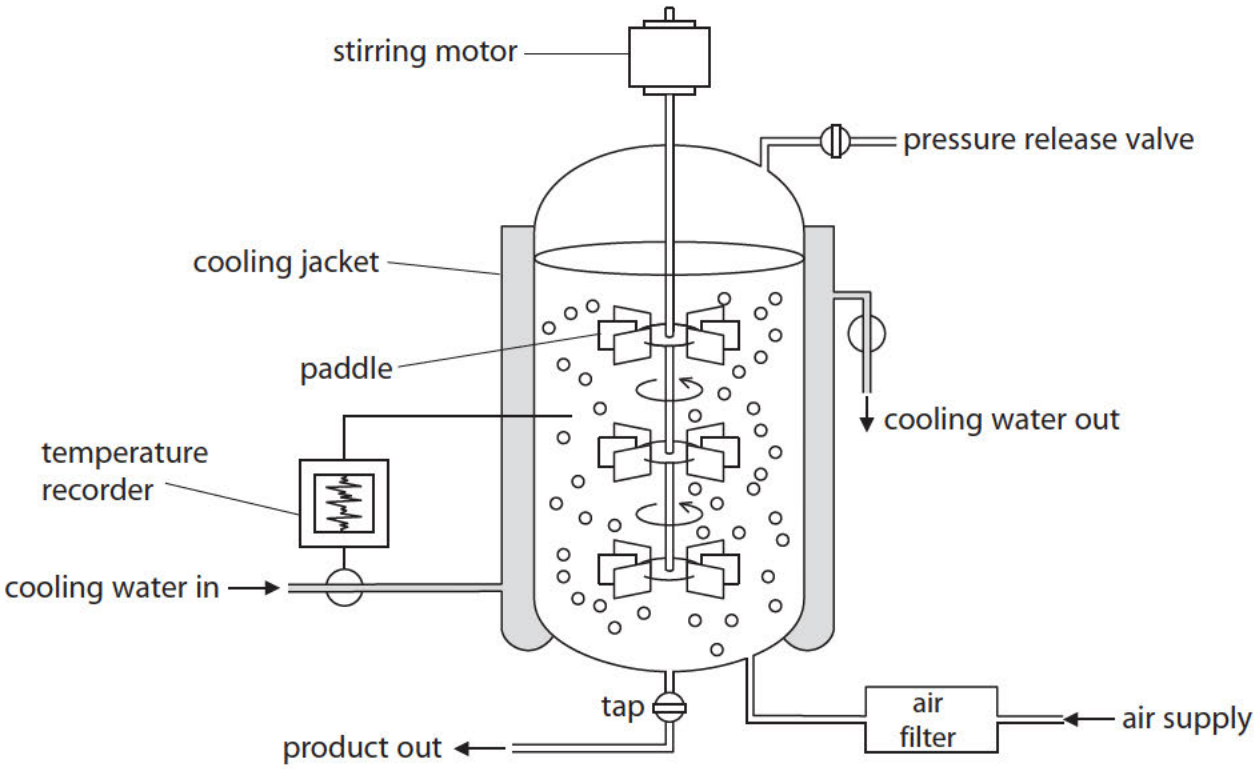
1 The diagram shows a fermenter used for growing micro-organisms.



(a) (i) Explain the function of the paddles in the fermenter.

(2)

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(ii) Explain why the pH in the fermenter needs to be controlled.

(2)

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(iii) Name one useful product that can be made in this fermenter.

(1)

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(b) Some micro-organisms grown in anaerobic conditions will produce a fuel called biogas.

Explain two changes that need to be made to the design of the fermenter so it can be used to produce biogas by anaerobic fermentation.

(2)

1 .....

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2 .....

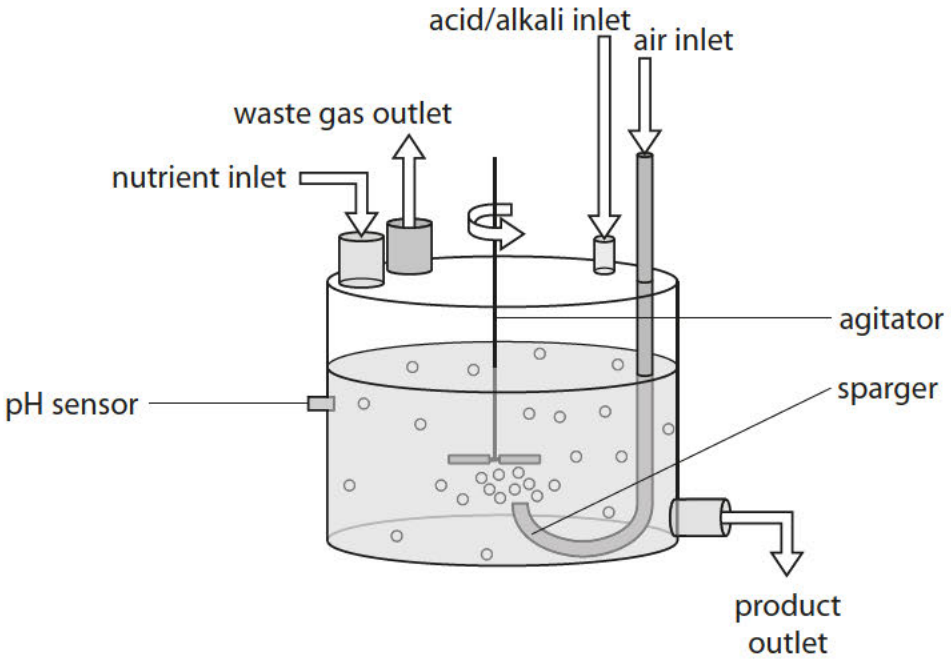
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(Total for Question = 7 marks)

2 The diagram shows a model of an industrial fermenter used to study how changes in conditions can affect the yield of products.



(a) An acid or alkali can flow through the acid/alkali inlet to maintain a constant pH within the fermenter.

Explain why the pH needs to be kept within a narrow range.

(3)

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(b) Parts of the fermenter responsible for regulating the temperature are not shown in the diagram.

Name two of these parts.

(2)

1 .....

2 .....

(c) This fermenter uses a sparger to introduce air into the fermenter.

Suggest why it is important to introduce air into the fermenter.

(2)

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(d) Before being used the empty fermenter is cleaned using steam.

Suggest why.

(2)

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(Total for Question = 9 marks)