

Phosphorus Uptake and Release

- a. certain bacteria of the genus *A* _____ (and others) possess the special metabolic capability to store large quantities of p _____.
- b. these bacteria are normally present in all aerobic suspended growth cultures, but only display enhanced biological phosphorus removal (EBPR) when they are cycled between a _____ and a _____ zones. The following mechanism has been proposed to explain EBPR:

c. mechanisms in the anaerobic environment

- i. as wastewater travels to the wastewater treatment plant the organic matter undergoes a certain amount of f _____ under anaerobic conditions, producing acetic acid and short-chain v _____ f _____ a _____ (VFA's).
- ii. acetic acid in its u _____ form (H_3CCOOH) is transported across the cell m _____.
- iii. the acetic acid d _____ to form acetate (H_3CCOO^-) and to maintain the hydrogen g _____, H^+ is expelled from the cell. This requires energy in the form of A _____.
- iv. the acetic acid is p _____ to form a long chain of p _____ - β - h _____. This also requires energy in the form of A _____.
- v. as the ATP to ADP ratio d _____, stored polyphosphate is hydrolyzed to r _____ the ATP, excess phosphate is released from the cell into the bulk solution.

Key Poly-P Reactions in Anaerobic Environment

1. Uptake of acetic acid
2. Stored polyphosphate is consumed
3. Storage polymer PHB is formed from acetic acid
4. Inorganic phosphorus is released into the bulk liquid

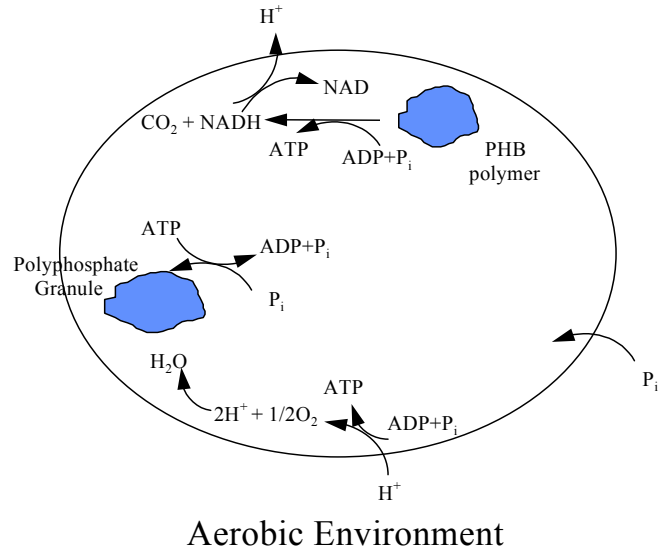
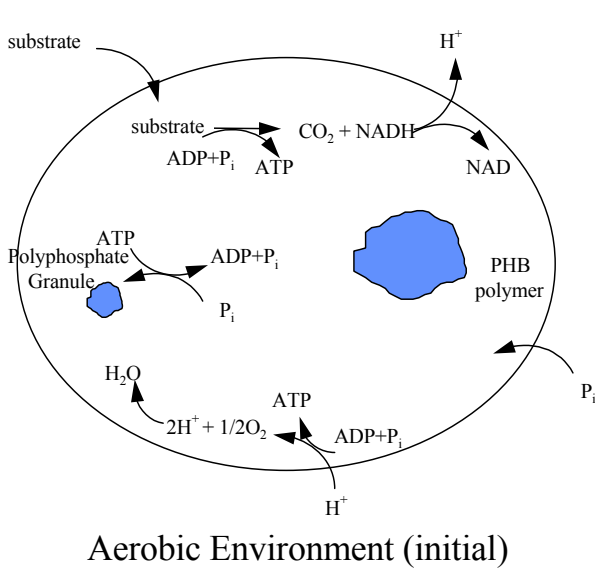
d. mechanisms in the aerobic environment

- i. soluble substrate is transported into the cell and ATP is produced through normal means (substrate level p _____ and r _____ chain linked phosphorylation).
- ii. due to the replenished supply of ATP, p _____ begins to be stored, and inorganic phosphate is taken up by the cells from the b _____ solution.
- iii. once the supply of external substrate is e _____, the cell uses its PHB reserves during endogenous metabolism to continue to manufacture polyphosphate and take p _____ into the cell.
- iv. the cycling between aerobic and anaerobic environments gives an a _____ to those bacteria which can a _____ and store p _____.

Key Poly-P Reactions in Anaerobic Environment

1. ATP is regenerated during the metabolism of *exogenous* substrate
2. Inorganic phosphorus is taken up by the cell from the bulk liquid and stored as polyphosphate
3. Once *exogenous* substrate is exhausted, the cell begins metabolizing its stored PHB reserves and continues to uptake phosphorus
4. Poly-P bacteria outcompete other bacteria without the ability to continue metabolism using stored energy reserves in the absence of exogenous substrate

AEROBIC ZONE



ANAEROBIC ZONE

