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NOTES

Strain improvement:

Strain is defined as a subgroup of a species of microorganism, with a characteristic distinguishing it from other subgroups.
Strain Improvement: is the science and technology of manipulating and improving microbial strains in order to enhance their metabolic capacities. It genetically modifies
the strain, improves existing desirable capabilities and eliminates undesirable qualities or adds new properties.
An efficient biotechnological process at industrial scale requires microbial strains which produce high titre of the desired product.

Ideal Characteristics of Strain:
A strain should show the following desirable characteristics -
Rapid growth, Shorter fermentation time, reduction of cultivation cost, Work at ambient temperatures, Improved use of carbon and nitrogen sources, elimination of the production of compounds that may interfere with downstream processing, ability to use cheaper substrates, should be non-toxic to humans and maintain genetic stability.

Purpose of Strain Improvement: This is mainly carried out to increase the productivity, Regulate the activity of enzymes, Increasing the permeability, To change unused co-metabolites, Introduce new genetic properties into the organism by Recombinant DNA technology / Genetic engineering.
The major motivation for industrial strain development is economic, since the metabolite concentrations produced by wild strains are too low for economical processes. So it may be desirable to isolate strains which require shorter fermentation times, which do not produce undesirable pigments, which have reduced oxygen needs, which exhibit decreased foaming during fermentation, or which are able to metabolize inexpensive substrates.
Wild strains frequently produce a mixture of chemically closely related substances. Hence mutants which synthesize one component as the main product are preferable, since they make possible a simplified process for product recovery.
Changes in the genotype of microorganisms can lead to the biosynthesis of new metabolites. Thus, mutants which synthesize modified antibiotics may be selected.

The focus is on isolating strains that require shorter fermentation time, do not produce undesirable pigments, tolerates reduced oxygen, resistant to bacteriophages
exhibits decreased foaming during fermentation, able to metabolize inexpensive substrates, selection of a morphologically favourable strain, selecting strains resistant to components in the medium.

Purpose of Industrial Strain Improvement:

- ✓ Increased fermentation productivity
- ✓ Regulate enzyme activity
- ✓ Introduce new genetic properties by rDNA technology
- ✓ Increase permeability
- ✓ improved resistance to infection
- ✓ improve effect of medium components

Approaches for Strain improvement :
Mutant Selection ('brute-force' technology)
Recombination
Recombinant DNA technology.
Wild strains: produce a mixture of products, but less product quantity.
Mutant strains: synthesize one main product thousand times more, simplifies recovery.
leads to new metabolites & modified antibiotics, decreases costs tremendously, has non-foaming capabilities, eliminates undesirable products or analogues, deciphering of new biosynthetic pathways leading to discovery of new antibiotics.

Genetic modification is achieved by
1. Mutation (not including foreign DNA). When the sequence of base pairs in a DNA molecule is altered to generate new genetic characters (genotypes).
Mutation where a gene is modified
: unintentionally & anytime (spontaneous mutation) errors during replication, transcription

: intentionally on adding mutagens, chemicals (benzene, ethidium bromide) UV, X-rays, (induced mutation)

Recombination (involving foreign DNA):
Conjugation: process by which genetic information is transferred by cell-to-cell contact in bacteria. Extra chromosomal DNA of the 'donor' cell integrates into the recipient.

Protoplast Fusion: where protoplasts are cells devoid of cell wall. Cell fusion and nuclear fusion result in a fused protoplast (mutant). Protoplast fusion between two non-producing Streptomyces strains yields a strain that produces a new Indolizine antibiotic.

rDNA Technology involves the isolation and cloning of genes of interest, transferring and expressing these genes into a suitable host.

The increase in fermentation productivity and decrease in costs is mainly due to mutagenesis and Recombinant DNA technology.
Thus the task of both - discovering new microbial compounds and improving the synthesis of known ones has become more challenging.