ASSIGNMENT

ON

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BY

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BIOCHEMISTRY TECHNOLOGY(SLT)

Question:

Write extensively on the primary and secondary screening of microorganisms.

Answer:

Screening of Microorganisms: Primary and Secondary Techniques

The screening of microorganisms is a critical process in microbiology, particularly in the fields of biotechnology and pharmaceuticals. It involves identifying and isolating microorganisms that possess desirable traits for industrial applications, such as the production of antibiotics, enzymes, or other metabolites. This process is generally divided into two main categories: primary screening and secondary screening.

Primary Screening of Microorganisms

Primary screening is the initial step in the selection process, aimed at detecting and isolating microorganisms based on their qualitative abilities to produce specific products. This stage typically involves sampling from natural environments, such as soil or water, where diverse microbial populations exist. The goal is to identify potential candidates that can be further analyzed for their utility in industrial applications.

Key Techniques in Primary Screening

1. Crowded Plate Technique: This method allows for the growth of multiple microorganisms on a single agar plate, facilitating the observation of interactions and the identification of those that produce desired metabolites.

2. Indicator Dye Technique: Utilizes dyes that change color in response to specific metabolic activities, making it easier to identify organisms with particular biochemical capabilities.
3. Enrichment Culture Technique: Involves cultivating microorganisms under selective conditions that favor the growth of specific types while inhibiting others, thereby enriching the population of interest.
4. Auxanographic Technique: This technique assesses the ability of microorganisms to utilize specific nutrients, helping to identify those with unique metabolic capabilities.
5. Supplementation Techniques: Involves adding volatile or organic substrates to culture media to enhance the growth of specific microorganisms known for producing desired compounds.

The primary screening process is crucial but can be labor-intensive and time-consuming, as it often requires evaluating a large number of isolates to identify a few promising candidates.

Secondary Screening of Microorganisms

Once potential candidates are identified through primary screening, secondary screening is conducted to evaluate their production capabilities in greater detail. This phase aims to provide quantitative data on the yield and quality of the desired products.

Objectives of Secondary Screening

- Assessment of Metabolite Production: Determining whether the isolated microorganism produces a new compound or an existing one.
- Yield Potential Evaluation: Measuring how much product can be produced by various isolates identified during primary screening.
- Optimization of Growth Conditions: Identifying optimal conditions such as pH, temperature, and aeration that maximize production yields.

- Genetic Stability Testing: Ensuring that the microorganism maintains its production capabilities over time without significant genetic drift.
- Chemical Stability Assessment: Evaluating how stable the produced metabolites are under various conditions.
- Physical Properties Analysis: Understanding characteristics such as solubility and toxicity which are critical for industrial applications.

Techniques Used in Secondary Screening

1. Giant Colony Technique: Specifically used for isolating antibiotic-producing strains like *Streptomyces*, this technique involves inoculating a central point on an agar plate and observing diffusion patterns to identify antibiotic activity.
2. Quantitative Methods: Techniques such as High-Performance Liquid Chromatography (HPLC) or spectrophotometry are employed to measure metabolite concentrations accurately.
3. Cultural Condition Optimization Trials: These trials help determine the best conditions for maximizing product yields through shake-flask cultures or pilot-scale fermentations.

Conclusion

The dual approach of primary and secondary screening plays a vital role in microbial biotechnology by facilitating the discovery and development of microorganisms with valuable industrial applications. While primary screening serves as an effective filter for potential candidates, secondary screening provides deeper insights into their production capabilities and stability, ensuring that only the most promising strains are selected for further development.

References:

1 Biotechnology Notes - Screening Techniques

2 PMC - Fundamentals on Screening Microorganisms