

Article :

**CHEMICAL ASPECTS OF MICROBIAL TRANSFORMATIONS**

DAMANDEEP KAUR AND K. K. CHAHAL

.....

Microbes have been evolving for nearly four billion years, and are capable of exploiting a vast range of energy sources, and thrive in almost every habitat. For two billion years microbes were the only form of life on earth. During this time, all basic biochemistries evolved and life forms developed from microbial ancestors. Microorganisms represent the richest repertoire of molecular and chemical diversity in nature and they underlie basic ecosystem processes, such as biogeochemical cycles. All the reactions wherein a compound is transformed to another compound by microorganisms come under microbial transformations. Constitutive or substrate-induced enzymes of secondary metabolism may bring about transformations or it might be due to an unpredictable lack of substrate specificity of essential enzymes in the microorganisms. These microbial transformation reactions are of interest to biologists or chemists, as they help to show that the vital functions of certain organized ferments are closely connected to molecular constitutions of bodies on which they live.

**Scope of microbial reactions :**

Microbial transformation reactions have very wide scope and are being used in the production of several chemical compounds. The following are the advantages in selecting microbial reactions as a rational supplement to the chemical synthesis.

Microbial reactions can be used to attack positions in the molecule which are not affected by chemical methods as they cannot be sufficiently activated or require a number of intermediate synthetic stages before they react chemically.

Oxygen functions or other

substituents can be introduced stereospecifically or altered with the possible formation of optically active centers.

Several reactions can be combined in one fermentation step and actually programmed to occur in a specific sequence if a suitable microorganism with a number of appropriate enzyme system is used.

The conditions under which microbial reactions takes place are mild, compounds which are sensitive to heat, acid and base become amenable to such transformations.

Due to these advantages, microbial transformations are being used immensely in industries and agriculture.

**Optimum conditions for microbial activity:**

Soil organisms are in constant competition for organically bound carbon and other nutrients. Their ability to get these growth materials depends on temperature, moisture, soil reaction (acidity or alkalinity) nutrient regimes of soil, appropriate source of energy and competition with other microorganisms. Since the soil microorganisms are of divergent nature, it is not possible to define the same favorable conditions for all microorganisms due to different optima exist in different groups of soil microorganisms. However conditions affecting activity of soil organisms can be generalized.

Dryness kills many microbes and many develop resistant strains or enter a dormant stage. Anaerobes grow best in waterlogged soil conditions. However, majority of them are active at field capacity soil moisture level. Microbes grow best under neutral conditions (pH 7.0). High organic matter and nutrients like nitrogen, phosphorus, sulfur and calcium in soil favour the growth of

See end of article for authors' affiliations

Correspondence to :  
**K.K. CHAHAL**  
Department of Biochemistry  
and Chemistry,  
Punjab Agricultural Univ.,  
LUDHIANA (PUNJAB)  
INDIA

Accepted : November, 2007

.....