M.G.V.C. ARTS, COMMERCE AND SCIENCE COLLEGE

MUDDEBIHAL

M.G.V.C. Arts, Commerce & Science College Dept. Botany MUDDEBIHAL -586212

CERTIFICATE

DEPARTMENT OF BOTANY

Examination Seat No S1827802 Class- B. Sc Sixth Semester

This is to certify that Mr. /Miss Swati S Rathod

Has satisfactorily completed the project work on Genetic improvement in industrial microbes Under my supervision in M.G.V.C. Arts, Commerce and Science College. Muddebihal during the year 2020-2021

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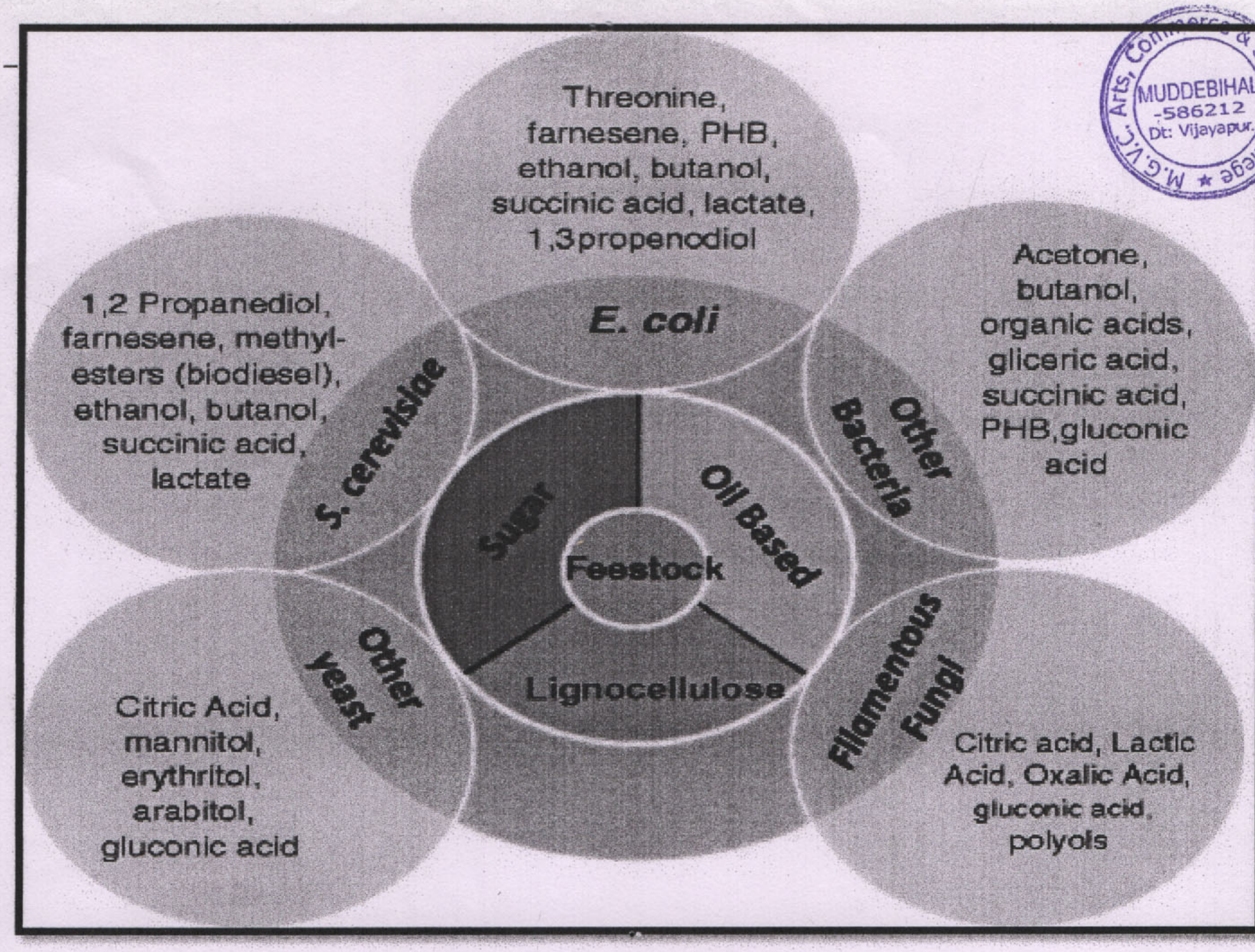
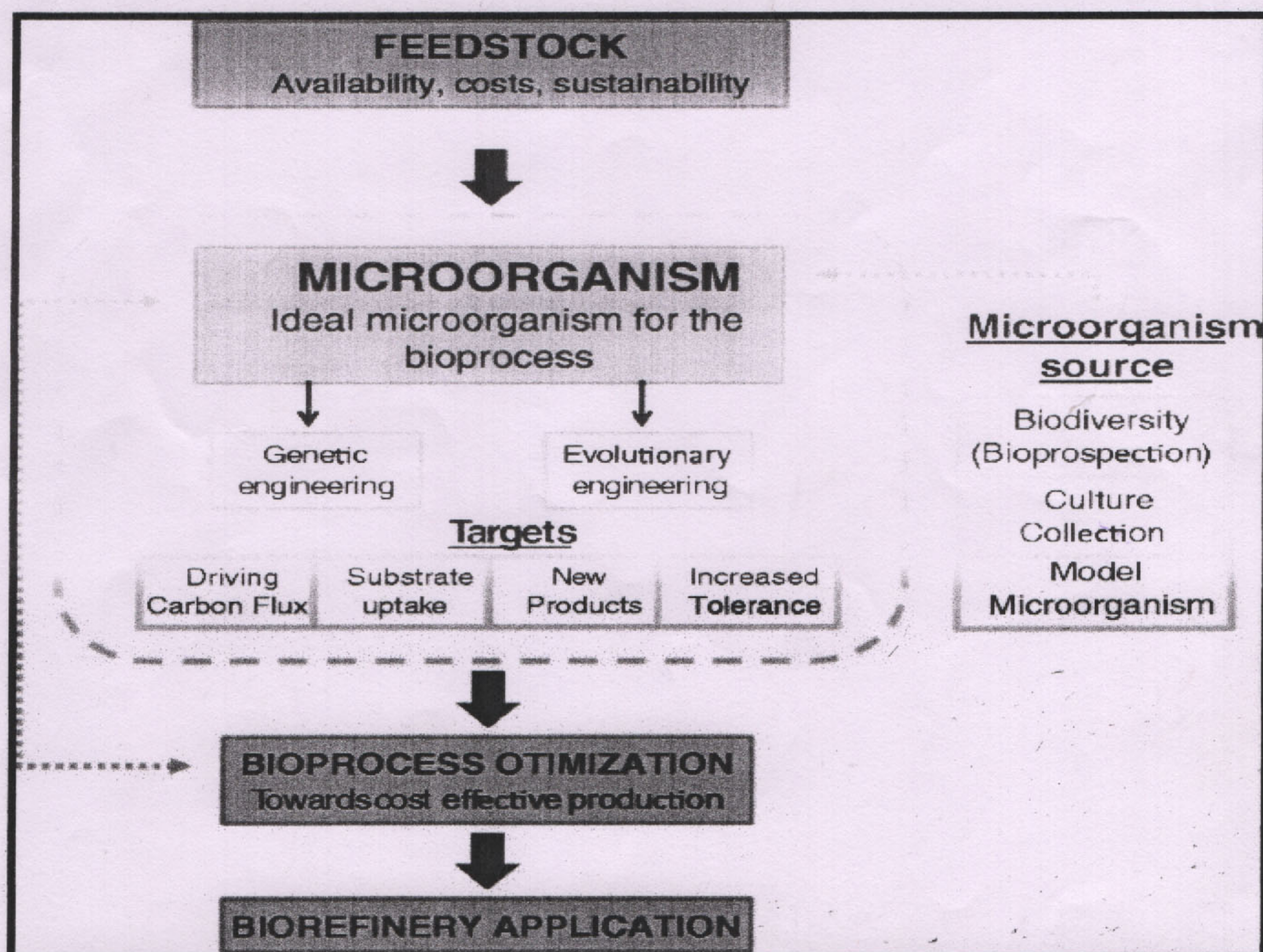
Genetic Improvement in industrial microbes

Microorganisms can generate new genetic characters ('genotypes') by two means: mutation and genetic recombination. In mutation, a gene is modified either unintentially ('spontaneous mutation') or intentially ('induced mutation'). Although the change is usually detrimental and eliminated by selection, some mutations are beneficial to the microorganism. Even if it is not beneficial to the organism, but beneficial to humans, the mutation can be detected by screening and can be preserved indefinitely. This is indeed what the fermentation microbiologists did in the strain development programs that led to the great expansion of the fermentation industry in the second half of the twentieth century.

It was fortunate that the intensive development of microbial genetics began in the 1940s when the fermentative production of penicillin became an international necessity. The early studies in basic genetics concentrated on the production of mutants and their properties. The ease with which 'permanent' characteristics of microorganisms could be changed by mutation and the simplicity of the mutation techniques had tremendous appeal to microbiologists. Thus began the cooperative 'strain-selection' program among workers at the U.S. Department of Agriculture Laboratories in Peoria, the Carnegie Institution, Stanford University and the University of Wisconsin, followed by the extensive individual programs that still exist today in industrial laboratories throughout the world. It is clear that mutation has been the major factor involved in the hundred- to thousand-fold increases obtained in production of microbial metabolites and that the ability to modify genetically a microbial culture to higher productivity has been the most important factor in keeping the fermentation industry in its viable, healthy state.


Threonine, farnesene, PHB, ethanol, butanol, succinic acid, lactate, 1,3propenodiol
E. coli
1,2 Propanediol, farnesene, methyl-esters (biodiesel), ethanol, butanol, succinic acid, lactate
S. cerevisiae
Acetone, butanol, organic acids, gliceric acid, succinic acid, PHB,gluconic acid
Other Bacteria
Sugar
Oil Based
Feestock
Lignocellulose
Other yeast
Citric Acid, mannitol, erythritol, arabitol, gluconic acid
Filamentous Fungi
Citric acid, Lactic Acid, Oxalic Acid, gluconic acid, polyols


FEEDSTOCK
Availability, costs, sustainability
MICROORGANISM
Ideal microorganism for the bioprocess
Genetic engineering
Evolutionary engineering
Targets
Driving Carbon Flux
Substrate uptake
New Products
Increased Tolerance
Microorganism source
Biodiversity (Bioprospection)
Culture Collection
Model Microorganism
BIOPROCESS OTIMIZATION
Towards cost effective production
BIOREFINERY APPLICATION

Nitrogen fixation and fermentation

Nitrogenous materials have long been used in agriculture as fertilizers, and in the course of the 19th century the importance of fixed nitrogen to growing plants was increasingly understood. Accordingly, ammonia released in making coke from coal was recovered and utilized as a fertilizer, as were deposits of sodium nitrate (saltpetre) from Chile. Wherever intensive agriculture was practiced, there arose a demand for nitrogen compounds to supplement the natural supply in the soil. At the same time, the increasing quantity of Chile saltpetre used to make gunpowder led to a worldwide search for natural deposits of this nitrogen compound. By the end of the 19th century it was clear that recoveries from the coal-carbonizing industry and the importation of Chilean nitrates could not meet future demands. Moreover, it was realized that, in the event of a major war, a nation cut off from the Chilean supply would soon be unable to manufacture munitions in adequate amounts.

During the first decade of the 20th century, intensive research efforts culminated in the development of several commercial nitrogen-fixation processes. The three most-productive approaches were the direct combination of nitrogen with oxygen, the reaction of nitrogen with calcium carbide, and the direct combination of nitrogen with hydrogen. In the first approach, air or any other uncombined mixture of oxygen and nitrogen is heated to a very high temperature, and a small portion of the mixture reacts to form the gas nitric oxide. The nitric oxide is then chemically converted to nitrates for use as fertilizers. By 1902 electric generators were in use at Niagara Falls, New York, to combine nitrogen and oxygen in the high temperatures of an electric arc. This venture failed commercially, but in 1904 Christian Birkeland and Samuel Eyde of

Norway used an arc method in a small plant that was the forerunner of several larger, commercially successful plants that were built in Norway and other countries.

The arc process, however, was costly and inherently inefficient in its use of energy, and it was soon abandoned for better processes. One such method used the reaction of nitrogen with calcium carbide at high temperatures to form calcium cyanamide, which hydrolyzes to ammonia and urea. The cyanamide process was utilized on a large scale by several countries before and during World War I, but it too was energy–intensive, and by 1918 the Haber–Bosch process had rendered it obsolete.

The Haber–Bosch process directly synthesizes ammonia from nitrogen and hydrogen and is the most economical nitrogen–fixation process known. About 1909 the German chemist Fritz Haber ascertained that nitrogen from the air could be combined with hydrogen under extremely high pressures and moderately high temperatures in the presence of an active catalyst to yield an extremely high proportion of ammonia, which is the starting point for the production of a wide range of nitrogen compounds. This process, made commercially feasible by Carl Bosch, came to be called the Haber–Bosch process or the synthetic ammonia process. Germany's successful reliance on this process during World War I led to a rapid expansion of the industry and the construction of similar plants in many other countries after the war. The Haber–Bosch method is now one of the largest and most–basic processes of the chemical industry throughout the world.