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Pasteur's role in microbial fermentation

Kumari R

Department of Microbial Sciences, Central University of Punjab, Bathinda, India

Corresponding Author: *Kumari R, Department of Microbial Sciences, Central University of Punjab, Bathinda, India, E-Mail: ritudubey0408@gmail.com*

INTRODUCTION

When I was a kid, I was fond of those delicious, crunchy, garlicky, sour pickles. Not only pickles but also bread, cheese, yogurt, sour cream, salami, chocolates, vinegar, wine, and beer are prominent in today's world. I used to wonder how this all started? A person named "Louis Pasteur" played a significant role in this field which is known as microbial fermentation. He is the person who demonstrated that growth of microorganisms is responsible for fermentation. I have focused on his work in microbial fermentation.

Fermentation - an anecdote:

Our knowledge of fermentation is a boon by Louis Pasteur. He is the one who gave the idea that fermented beverages are the result of nothing but are the action of microorganisms that are capable of converting sugar into alcohol from grape juice and defined it as respiration in the absence of air [1]. By this experiment he came to know that along with alcohol and carbon dioxide, there was also a notable amount of succinic acid, glycerine, and amylic alcohol. According to him, fermentation is the result of yeast multiplication and yeast must be alive to produce alcohol. It all started around 19th century when the French wine industry was perturbed by different ailments that were directly related to the souring of wine [2]. This ailment was also referred as French Wine Disease at that time. The buzz of this malady spread throughout the Europe, and that affected the wine export sector in France. There was a person named Monsieur Bigot who was the father of his pupil who was the owner of an alcohol factory, came to Pasteur with this intriguing issue. Also, he was given the responsibility to decode this mess [3].

Louis went to the factory. He observed that in some vats the juice was turning into alcohol while in some, there was slimy sour liquid. He examined the sample under the microscope. He observed thousands of yeast cells in the sample which wasn't sour. But when he peered at a drop of liquid from sour vats, he saw millions of tiny black rods which were smaller than yeast cells [4]. He realized that these were bacteria, and they had invaded the yeast cells, and instead of producing carbon dioxide and alcohol, they were producing lactic acid (acid that sours milk) although at that point of time he was not able to find any remedy for Bigot's problem but he knew the reason behind it. His findings showed that there were mainly two types of fermentation-

Alcoholic Fermentation (which occurs by the action of yeast).

Lactic Acid Fermentation (caused by the action of bacteria such as the genera of Lactobacillus, Leuconostoc, Pedioccocus and Streptococcus are the main species involved).

CONCLUSION

In a nutshell, we can conclude that in grape juice, high sugar concentration and low protein content (i.e. low buffering power) leads to a low pH, which allows the outgrowth of acid resistant yeast and thus yields an alcoholic fermentation. In milk, in contrast, the much higher protein and lower sugar content favor the outgrowth of fast growing but more acid-sensitive bacteria which cause lactic acid fermentation. This finding led Pasteur to state that specific microbes might also be the causes of particular disease in man. This was all about Pasteur's role in microbial fermentation [1].

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