

**BACILLUS THURINGIENSIS DEVELOPMENT FROM 1971 TO 1996:
CASES OF A RESEARCH GROUP IN BRAZIL**

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ABSTRACT

Brazil is internationally known for its activities in mass production and use of biocontrol agents. Batch studies on *Bacillus thuringiensis* fermentation were initiated in 1970, at the State University of Campinas (UNICAMP) to explore the feasibility of producing endotoxin preparations, using cheap liquid by-products as fermentation substrates. The culture media composition, its price, and their influence on the final cost were studied for mini- and pilot-scale production. The results obtained generated two industrial patents on the fermentation process, using sugar cane molasses and corn steep liquor as sources of nutrients. Besides these studies, others such as rheological characteristics of many culture media and the culture broths, the influence of aeration and agitation levels on growth and sporulation, the continuous technique affecting growth and sporulation rate, the effects of different ways of drying on the viability of the spores and the potency of the insecticide obtained, as well as the solid state fermentation were developed. These studies were done as Master and Ph.D. theses, and some results were published from 1971 to 1996.

KEY WORDS: *Bacillus thuringiensis* case studies, fermentation processes, biopesticide, endotoxin preparations, agroindustrial residues, waste water residues, low cost substrates.

INTRODUCTION

The first use of a *Bacillus thuringiensis* (*Bt*) biopesticide was registered in Brazil, as a result of applications of the imported product by researchers of the Centennial Agricultural Institute of Campinas in the state of S. Paulo. However, Brazilian studies about *Bt* started in 1970 with the initiation of a Master of Science thesis (Moraes, 1973).

Since then, many researches have been developed. They had as subject processes of both submerged and solid state fermentation. The engineering parameters, agitation and aeration in submerged fermentation were studied (Moraes et al., 1981). After separation of the culture broth, the thermobacteriological indexes *z* and *D* in the drying process, with conventional and spray dryers were determined (Arruda, 1993).

CONCLUSIONS

The results of the research on *Bt* and its applications developed in Brazil, showed the potential of producing this powerful bioinsecticide regionally, using many types of agricultural residues. This is because Brazil is a very big country and has different climates, soils, humid and arid areas, where one can find low cost substrates to develop a regional, inexpensive production.

By using cheap substrates — agricultural residues and agroindustrial waste water, with a good carbon–nitrogen balance (as well as vitamins and mineral salts composition), it was possible to compose low cost culture media to be used in the process, whether in submerged or solid state fermentation.

Brazilian losses with agricultural products amount to almost forty percent of the total production. The process is available to technology transfer, to be produced in several states of this big country that is Brazil, or countries where these types of residues are available and insect pests pose a problem.

ACKNOWLEDGEMENTS

We acknowledge the support of CNPq — Conselho Nacional de Pesquisa e Desenvolvimento; FAPESP — Fundação de Apoio à Pesquisa do Estado de S. Paulo; and OEA — Organização dos Estados Americanos.

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