

Reducing the Impact of Pathogenic Fungi on Barley Using Bacteria: Bacterial Biocontrol in the Barley-Malt-Beer Industry

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Abstract : Pathogenic fungi represent a generic problem for cereals, including barley, as they can produce a number of thermostable toxic metabolites such as mycotoxins that contaminate plants and food products, leading to serious health issues for humans and animals and causing significant losses in global food production. In addition, mycotoxins represent a significant technological concern for the malting and brewing industries, as they may affect the quality and safety of raw materials (barley and malt) and final products (beer). Moreover, this situation is worsening due to the highly variable climatic conditions that favor microbial development and the societal desire to reduce the use of phytosanitary products, including fungicides. In this complex environmental, regulatory and economic context for the French barley-malt-beer industry, this project aims to develop an innovative biocontrol process by using technological bacteria, isolated from infection-resistant barley cultures, that are able to reduce the development of spoilage fungi and the associated mycotoxin production. The experimental approach consists of i) coculturing bacterial and pathogenic fungal strains in solid and liquid media to access the growth kinetics of these microorganisms and to evaluate the impact of these bacteria on fungal growth and mycotoxin production; then ii) the results will be used to carry out a micro-malting process in order to develop the aforementioned process, and iii) the technological and sanitary properties of the generated barley malts will finally be evaluated in order to validate the biocontrol process developed. The process is expected to make it possible to guarantee, with controlled costs, an irreproachable hygienic and technological quality of the malt, despite the increasingly complex and variable conditions for barley production. Thus, the results will not only make it possible to maintain the dominant world position of the French barley-malt chain but will also allow it to conquer emerging markets, mainly in Africa and Asia. The use of this process will also contribute to the reduction of the use of phytosanitary products in the field for barley production while reducing the level of contamination of malting plant effluents. Its environmental impact would therefore be significant, especially considering that barley is the fourth most-produced cereal in the world.

Keywords : barley, pathogenic fungi, mycotoxins, malting, bacterial biocontrol

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