SYNTHESIS AND EVALUATION OF THE BIOLOGICAL ACTIVITY OF NEW BISBENZIMIDAZOLE DERIVATIVES: STUDY OF BACTERIAL FLOCCULATION PROPERTIES

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In the field of microbiology, the flocculation of microbial cells is a phenomenon during which the cells follow a sedimentation process after incubation with a charged, natural or synthetic flocculating agent. This phenomenon has shown a growing interest in recent years due to its applications in various fields ranging from wastewater treatment to biocatalysis or biodegradation processes(1). In particular, the use of flocculated bacterial cells has offered an attractive prospect for obtaining molecules of industrial interest using optimized biocatalysis processes involving immobilized cells(2). However, the flocculating agents currently being developed present various constraints preventing their use on industrial scale. Among these, their mechanism of action (based mainly on electrostatic interactions between the bacterial membranes and the flocculating agents(3)), their toxicity or their high cost may be a limiting factor(1).

In recent studies, we noticed that bisbenzimidazole structures exhibit a significant activity against both Gram (+) and Gram (-) bacterial strains, characterized by the rapid appearance (within a few minutes) of bacterial flocs when the bacterial suspension is incubated with a low concentration of product. Interestingly, the synthesis of a chemical library of bisbenzimidazole derivatives allowed to highlight some structural criteria essential for the expression of such activity. Moreover, the structure of the evaluated heterocycles suggests a different mechanism of action from the classical “positively-charged” flocculating agents currently being developed. To go further into the comprehension of this phenomenon, we decided to carry out some additional studies including microscopic studies using Scanning Electron Microscopy (SEM) and confocal fluorescence microscopy alongside with metabolomic experiments.

Therefore, due to their significant flocculation activity and their innovative mechanism of action, we believe that our bisbenzimidazole derivatives offer an attractive prospect for the development of new agents with improved flocculation properties.

References

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