

Valorisation of Pineapple Core Waste-Derived Bromelain as a Sustainable Bioactive Agent Against Periodontitis-Associated Biofilms

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Abstract:

Bromelain, a cysteine protease enzyme complex naturally present in pineapple (*Ananas comosus*), possesses notable proteolytic properties. In this study, bromelain extracted from MD2 pineapple core waste was explored as a natural bioactive compound for mitigating biofilm-associated oral infections. The persistent biofilm formation underlying periodontitis represents a significant therapeutic challenge, thereby highlighting the potential of enzymatic agents such as bromelain for biofilm disruption. The effects of bromelain exposure on 3D-biofilm structure and bacterial morphology were evaluated using dual-species biofilms of *Streptococcus mutans* and *Fusobacterium nucleatum*, two major periodontopathogenic bacteria. Bromelain was isolated via ammonium sulphate precipitation followed by ultrafiltration, yielding ultrafiltrated bromelain (UFB). Microscopic visualization (40 \times magnification) demonstrated notable disruption of the biofilm structure, with reduced surface coverage and density