Characterization and antimicrobial activity of water-soluble N-(4-carboxybutyroyl) chitosans against some plant pathogenic bacteria and Fungi

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a b s t r a c t

Water-soluble N-(4-carboxybutyroyl) chitosan derivatives with different degrees of substitution (DS) were synthesized to enhance the antimicrobial activity of chitosan molecule against plant pathogens.

Chitosan in a solution of 2% aqueous acetic acid–methanol (1:1, v/v) was reacted with 0.1, 0.3, 0.6 and 1 mol of glutaric anhydride to give N-(4-carboxybutyroyl) chitosans at DS of 0.10, 0.25, 0.48 and 0.53, respectively.

The chemical structures and DS were characterized by 1H and 13C NMR spectroscopy, which showed that the acylate reaction took place at the N-position of chitosan. The synthesized derivatives were more soluble than the native chitosan in water and in dilute aqueous acetic acid and sodium hydroxide solutions.

The antimicrobial activity was in vitro investigated against the most economic plant pathogenic bacteria of Agrobacterium tumefaciens and Erwinia carotovora and fungi of Botrytis cinerea, Pythium debaryanum and Rhizoctonia solani.

The antimicrobial activity of N-(4-carboxybutyroyl) chitosans was strengthened

than the un-modified chitosan with the increase of the DS. A compound of DS 0.53 was the most active one with minimum inhibitory concentration (MIC) of 725 and 800 mg/L against E. carotovora and A.
tumefaciens, respectively and also in mycelial growth inhibiation against B. cinerea (EC50 = 899 mg/L), P.
debaryanum (EC50 = 467 mg/L) and R. solani (EC50 = 1413 mg/L

Keywords:
Chitosan
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1H and 13C NMR spectroscopy
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