UNIVERSITI TEKNOLOGI MARA

EFFECTS OF MICROWAVE IRRADIATION ON FILM MADE OF PECTIN

NUURUL AELIAH ABDULLAH

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ABSTRACT

The effects of microwave irradiation on pectin film through subjecting the pectin solution to microwave treatment prior to its conversion into a solid film were investigated. The pectin solution was treated by microwave at 80 W for 2, 4, 8, 16, 30 and 50 min. The formed film was then subjected to Fourier transform infra-red spectroscopy, molecular weight and thermogravimetric analysis. Practically, pectin-pectin interaction via O-H functional groups decreased, while pectin-pectin interaction via C-O functional groups increased in film with the introduction of microwave during the course of film preparation. In the case of polymer chain length, the molecular weight of pectin in film was found to reduce upon subjecting the pectin solution to microwave irradiation particularly for a prolonged period of time. The thermal stability of pectin film was increased particularly for sample made of pectin solution treated by microwave at 80 W for 16 min. A marked increase in the thermal stability of pectin film was attributed to the interplay between pectin-pectin interaction and pectin molecular weight.

CHAPTER 1

INTRODUCTION

Pectin is a non-starch, linear polysaccharide present in the cell walls of all plant tissues. It has a primary function as an inter-cellular and intra-cellular cementing material. Pectin has a few hundred to about one thousand building blocks per molecule, corresponding to an average molecular weight ranging from 50, 000 to about 180, 000 Da (Sinha and Kumria, 2001). Pectin is available naturally as partial methyl ester of $\alpha - (1 \rightarrow 4)$ linked D-polygalacturonate sequences interrupted with $(1\rightarrow 2)$-L-rhamnose residues. Other natural sugars which form the side chain of pectin include D-galactose, L-arabinose, D-xylose, and L-fucose (Shim *et al.*, 2004).

The carboxylic acid group in the 6 position of galacturonic acid can be esterified into methylesters. Depending on the degree of methylation (DM), pectin can be classified into low methoxylated (LM) pectin where the DM is less than 50 and high methoxylated (HM) pectin with a DM more than 50. The DM will affect the gelation ability of pectin (Hiorth *et al.*, 2005). HM pectin will form gels in the presence of water activity-depressing compounds, such as sucrose, at low pH values. On the other hand, LM pectin will gel in the presence of divalent ions such as calcium, through associations between sequences of charged groups belonging to two different chains.