BIOCHEMICAL CHANGES DURING

DATE PALM FRUITS RIPENING

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A THESIS

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Abstract

All fruits and vegetables undergo major biochemical transformations during the ripening process that change one or more physical attributes of the produce. This study examined biochemical changes associated with ripening of four different varieties of date fruits: sukkari, hilwa, sullaj, and khalas. For each date fruit variety, ten different sets of samples representing 10 different stages of maturity were collected and extracted with either methanol for analysis of pigments or aqueous buffer for analysis of proteins, sugars, and enzymes. The results showed that ripening of date fruits has increased the fruit content of soluble proteins, sugars, certain enzymes activities, and certain polyphenols. Ripening process of date fruits was also associated with degradation of chlorophylls, carotenes, and virtually all pigments that were originally present in unripened fruits. While these results were consistent with ripening of all fruits, the date fruits varieties examined in this study exhibited considerable variations among them. None of the varieties examined exhibited measurable levels of cellulase activity, or modulation of pectinase activity during ripening. By contrast, induction of amylase activity showed chronological and quantitative variations among date varieties. In all cases examined, the increase in amylase activity appeared to coincide with proportional increase in reducing-sugar content of fruits suggesting a correlation between amylase activity and reducing-sugars content in date fruits. All date varieties showed elevated, but variable levels of polyphenol oxidase (PPO) in the same time frame at which date fruits began to change color from yellow or red (according to variety) to brown. The level of PPO activity in all date varieties was 10-100 folds higher than any other enzyme examined in this study, and there appeared to be a relationship between PPO activity present in a date fruit and the intensity of its color at maturation. Thus, PPO

activity might be responsible for the natural brown color of all date fruits, possibly via oxidation of polyphenols, which are abundant in all date varieties.

At the early stages of ripening, all date fruits examined in this study contained similar amounts of chlorophylls and carotenoids, with the exception of khalas variety, which had much higher concentrations of chlorophylls. Ripening resulted in rapid and concurrent degradation of chlorophylls and carotenes in all date varieties, but degradation of chlorophylls was faster than that of carotenes. Among the date varieties examined, only hilwa had measurable levels of anthocyanins, which were synthesized and degraded during its ripening process. Absorption spectroscopy revealed that virtually all original pigments of unripened date fruits were degraded during the ripening process and were replaced by new pigments.

In summary, the results presented here showed that ripening processes of date fruits might involve common pathways as well as unique ones. Common pathways may account for changing of colors, production of sugars, and induction of certain enzymes. However, the quality and taste of the ripen fruits might be influenced by components other than the classical ones. Identification of such components might be a worthwhile endeavor, both scientifically and commercially.