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Effects of natural pigments on the poly(methyl methacrylate) biopolymer

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This research deals with the effects of natural pigments (chlorophyll and anthocyanin) on the secondary (Engineering) bonds in the poly(methyl methacrylate) which play an important role on the physical and chemical properties of polymer. Natural pigments extracted from plants by a simple method shows a good agreement with the standard one which characterized by Ultraviolet–Visible (UV–Vis) Spectroscopy and Fourier Transform Infrared (FTIR) Spectroscopy. The blend of poly(methyl methacrylate) (PMMA) with pigments were characterized by FTIR, differential scanning calorimeter (DSC), hardness, and density. Hardness of PMMA decreases as concentration of pigment increases while density show decrease by anthocyanin comparatively higher than chlorophyll. This is due to the presence of many hydroxyl groups in anthocyanin molecule than in chlorophyll molecule, so it diffuses more in the PMMA polymer and creates voids between the polymer chains which destroy secondary bonds. Results show that anthocyanin shows higher depression in glass transition temperature (Tg) of PMMA than chlorophyll where its maximum effect is 3%. From glass transition temperature(Tg) data for a linear unbranched polymer , the energies provided by the pigments to destroy Van der Waals bonds (secondary or engineering bonds) as a function of pigment concentration result in (lowering Tg value of the polymer), partially raptured of the secondary bonds especially for molecule with abnormal energy than others. From the above table, it seems that pigments are providing small amounts of energy to depress Tg of the PMMA biopolymer. All results showed that natural pigments enter between polymers chains and destroy secondary bonds and act as plasticizers (lowering the rigidity of the polymer chains) of poly (methyl methacrylate).

Pigment	Glass transition temperature (°C)	Given energy by added pigments (kJ mol^{-1})
Pure PMMA	64.1	----
3% chlorophyll	57.4	5.12
7% chlorophyll	58.0	4.68
3% anthocyanin	58.7	4.16
7% anthocyanin	55.1	6.83

Biography

Jaleel Kareem Ahmed has completed his PhD from Baghdad University. He is the Dean of the Institute of Foundry and Hammering. He has registered 8 patents with 40 published papers and 3 books. He is a member in Who is Who network. He is a reviewer in Jon Wily and Sons and Editorial Board Member of Science Publishing Group and a member in Encyclopedia of Chemistry Scientists. He has got the Iraqi Scientist Medal. Currently, he is a Professor of physical chemistry in the College of Materials Engineering , Babylon University, Iraq.

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