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Comparison Of Dna Binding Studies Of Polymers From Non-Edible Oils

[1] **T. Sahaya Maria Jeyaseeli, [2]J. Shakina, [3]P.Tharmaraj**

[1&2]Assistant Professor, Department of Chemistry, Sarah Tucker College, (Autonomous) Tirunelveli - 627 007, Affiliated to Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu, India.

[2]Associate Professor, Department of Chemistry and Research Centre, Thiyagarajar College, Affiliated to Madurai Kamaraj University, Madurai, Tamilnadu, India

Abstract: Non-edible oils like Hydnocarpus Wightiana oil, Chennakai oil and Sarcostigma Kleinii oil are the exceptional raw material for new polymers. These oils vary in their structure and potential applications. Vegetable oils show a comprehensive of bioactivities, especially antimicrobial activity, and have long been utilized for treating various human disorders and diseases. The morphological properties are studied by the use of scanning electron microscopy (SEM).The synthesized polymers were characterized by microbial studies and DNA binding studies.

Keywords: Non-edible,antimicrobial,morphological,polymer,microbial

1. Introduction

Vegetable oils are encouraging renewable resources for polymers because of their ready availability and multipurpose applications. Moreover the production of polymer is eco-friendly and cost effective. The plant oils are consisted with triglycerides in which the reactivity of the functional groups in their structure can be modified [1]. Synthesis of resins from plant oil involves chemical modifications of unsaturated oils to undergo crosslinking. This cross linking was responsible for good mechanical and thermal properties of the resins [2]. Hydnocarpus Wightiana seed oil has been shown to be highly active against microbial [3]. It is used to treat different kinds of wound and also speed up the healing process of cuts and bruises. Sarcostigma Kleinii Oil (SKO) is also known as Odal. This oil is extracted from the seeds. It is esteemed as a cure for rheumatism. Chennakai oil is extracted from medicinal plants. It is utilized in traditional medicine. It can have a range of beneficial preventive properties.Binding studies of polymer molecules to DNA are essential in the development of DNA molecular analysis. Interaction between polymer molecules and DNA can cause damage in cancer cells, blocking the division and resulting in cell death [4]. The binding constant K_b suggests that a strong binding exists between polymers (HWOP, COP, and SKOP) and CT-DNA

2. Experimental

Hydnocarpus Wightiana oil (HWO), Chennakai oil (CO) and Sarcostigma kleinii oil (SKO) were purchased from local market, Formic acid (97%) (Rankem), Hydrogen peroxide (30%) (Rankem) were used in the first step functionalization. Maleic anhydride (Rankem) and Morpholine (Rankem). Benzoyl peroxide (Rankem) was used as a radical initiator and N, N-Dimethyl aniline (Rankem) was used as accelerator in the curing process. Styrene (Rankem) was used as a vinyl co-monomer. All the chemicals were used as received.

2.1. Synthesis and characterization of Poly (Hydnocarpus Wightiana oil/ Chennakai oil /Sarcostigma Kleinii oil fumarate) biopolyesters resins (PHWOFRS/PCOFRS/PSKOFRS)

Stage 1: Poly (Hydnocarpus Wightiana oil/ Chennakai oil / Sarcostigma Kleinii oil fumarate) biopolyester resin was prepared by stirring Hydnocarpus Wightiana oil/ Chennakai oil / Sarcostigma Kleinii oil (100 mL), HCOOH (100 mL of 97%) and H_2O_2 (55 mL of 30%) under ice bath at temperature below 4^0C. The resulting product was obtained as poly hydroxylated Hydnocarpus Wightiana oil / Chennakai oil / Sarcostigma Kleinii Oil (PHHWO/PHCO/PHSKO)

Stage2: The polyol resin (PHHWO/PHCO/PHSKO) was heated with maleic anhydride (1:2) at 70^0C and added morpholine (1 mL), after 2 hours a golden yellow viscous liquid was obtained. The resulting product was oligomerised HWO/CO/SKO fumarate resin.

2.2. Synthesis and characterization of poly (Hydnocarpus Wightiana oil / Chennakai oil / Sarcostigma Kleinii oil fumarate) biopolyesters resins (PHWOFRS/PHCOFRS/PHSKOFRS)

Synthesis of HWO/CO/SKO polyester was carried out by the free radical addition polymerization reaction using the oligomerised HWO/CO/SKO fumarate resin and styrene at different concentration with benzoyl peroxide (2 wt %) as catalyst and Dimethylaniline (0.5 wt%)as the accelerator. The viscous liquid is transferred in to the glass mould coated with silicon oil at room temperature. The polyester thin film of different concentration such as 1:0.5, 1:1 and 1:2 were synthesized from the resin and styrene. Finally, yellow coloured polyesters sheets obtained were removed from the mould.

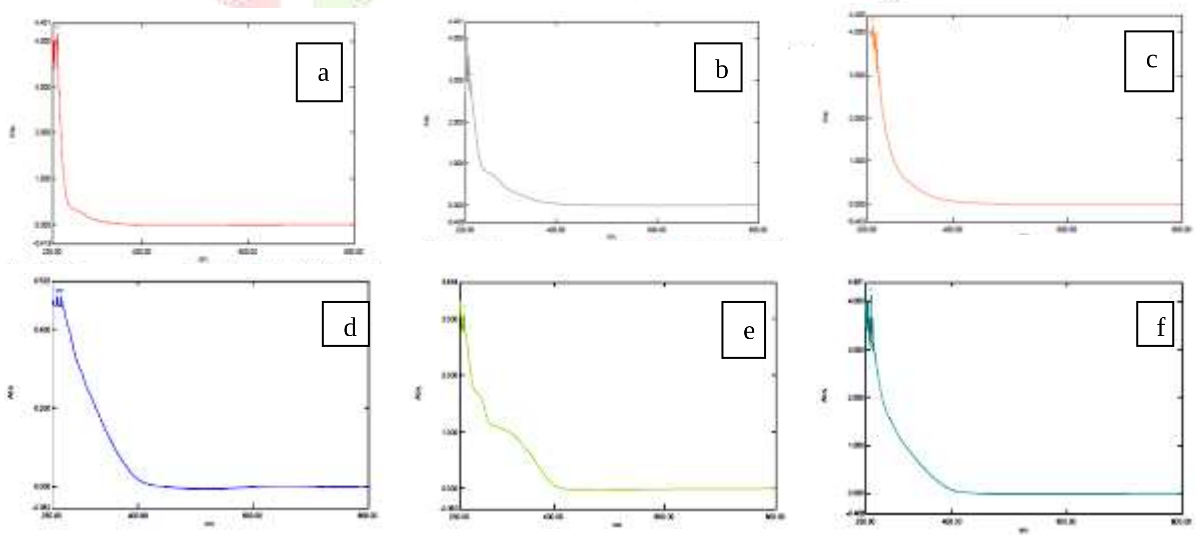
Characterization of polymers

UV and FT-IR spectroscopy were used to characterize the synthesized resins in order to testify the chemical modification reactions. The UV and FTIR analysis were carried out for HWO, CO, SKO and hydroxylated HWO, CO, SKO also the respective resins. Cured samples were also checked to see the degree of curing.SEM analysis was carried out to know about the surface property of the polymer. Microbial studies were carried out by agar diffusion method.

3. Result and discussion

3.1.UV analysis

Figure 3.1 shows the UV spectra of Hydnocarpus Wightiana oil / Chennakai oil / Sarcostigma Kleinni oil, hydroxylated triglyceride oil resins and O-PTF resins. They have been investigated (230 nm - 800 nm). UV Spectra of samples (Hydnocarpus Wightiana oil / Chennakai oil / Sarcostigma Kleinni oil) showed an electronic absorption band around 239, 295.50 and 238 nm respectively. The hydroxylated resins exhibited a blue shift when compared with the corresponding parent oil which is attributed to the substitution of hydroxyl group at the unsaturated moiety [5]. The substantial red shift exhibited in resins due to the distortion in geometry of the molecule by the introduction of fumarate group.



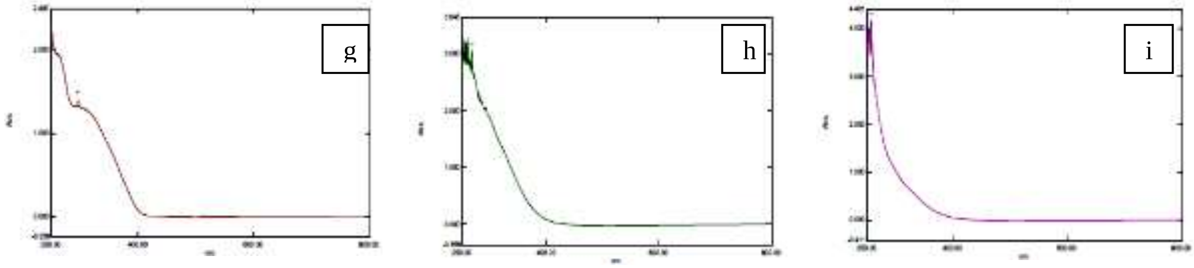


Figure3.1: UV Spectrum of (a) Hydnocarpus Wightiana oil (b) Hydroxylated Hydnocarpus Wightiana oil (c) Hydnocarpus Wightiana Resin (d) Chennakai oil (e)Hydroxylated Chennakai oil (f) Chennakai Resin (g) Odal oil (h) Hydroxylated Odal oil (i) Odal Resin

3.2. FTIR spectral analysis

Figure 3.2 shows the IR spectra of Hydnocarpus Wightiana oil / Chennakai oil / Sarcostigma Kleinni oil, hydroxylated triglyceride oil and their resins. They have been investigated between 500 cm^{-1} to 4000 cm^{-1}. FT-IR spectra of hydroxylated triglyceride resins showed a strong absorption band at 3522, 3770.58, 3772.5 cm^{-1}respectively, due to the presence of free –OH group in the molecule. The corresponding peaks are completely reduced in the resins indicates the entire OH group get substituted [6].

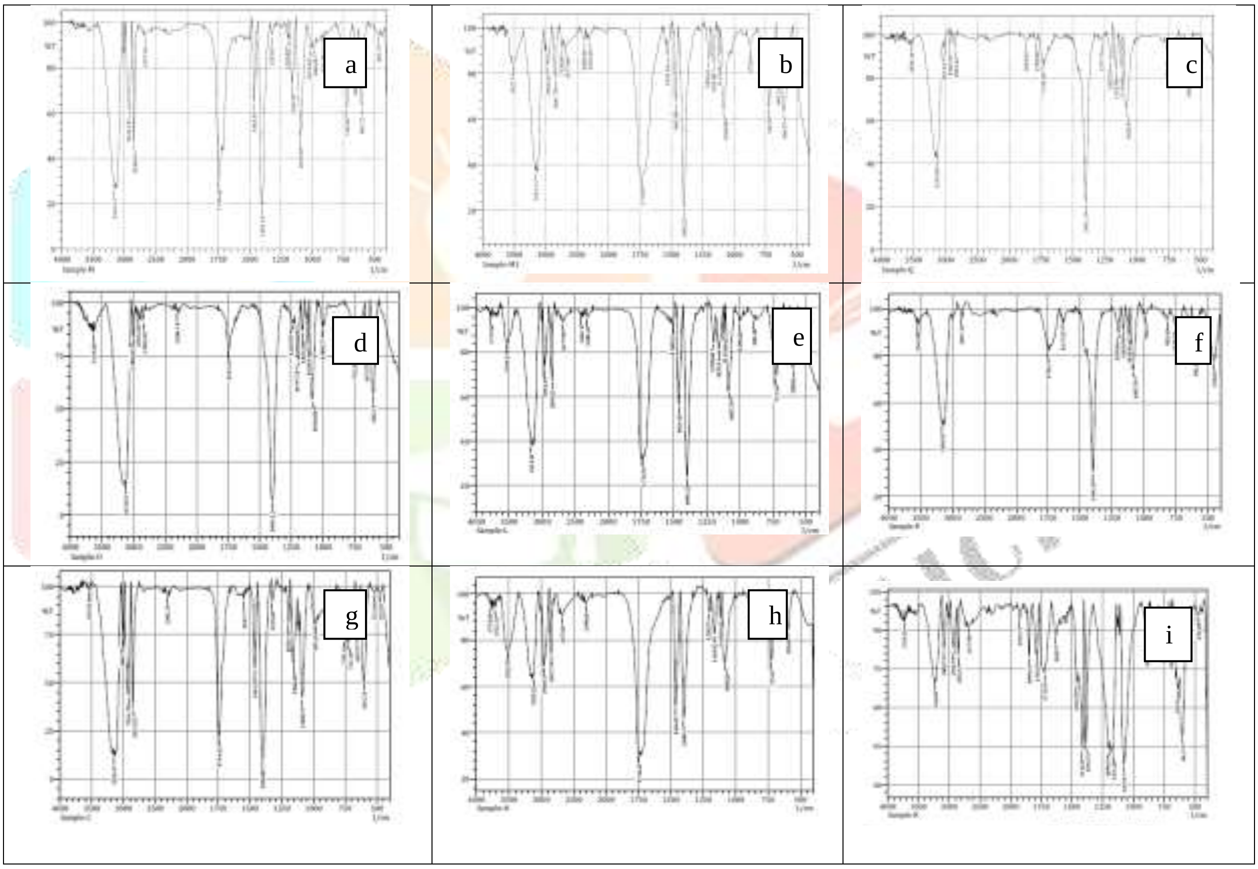


Figure 3.2: IR Spectrum of (a)Hydnocarpus Wightiana oil (b) Hydroxylated Hydnocarpus Wightiana oil (c) Hydnocarpus Wightiana Resin (d) Chennakai oil (e)Hydroxylated Chennakai oil (f) Chennakai Resin (g) Odal oil (h) Hydroxylated Odal oil (i) Odal Resin

3.3. Microbial studies

Anti bacterials present in the polymer composites were detected by Agar well diffusion method using bacterial strains Actinomycetes Israelii and Aeromonas hydrophilla. The microbial studies were assayed by measuring the diameter of the inhibition zone. Polymers from HWO, CO and SKO show their actions against bacterial and fungal infections [7]. Antifungal present in the polymer composites were detected by Agar well diffusion method using fungal strain Aspergillus Niger. The newly prepared biopolyesters has been used to study the bacterial strains Actinomycetes Israelii, Aeromonas hydrophilla and fungal strain Aspergillus Niger. The HWOP, COP and SKOP showed potential microbial activity against micro organisms [8]. The results show that polymer composites retard the growth of microorganisms.

3.4. SEM analysis

Scanning electron micrographs of HWOP, COP, and SKOP are shown in Figure 3.3. Surface SEM images of the polyesters have symmetric chain units in parallel, uniformly distributed and has a good network pattern [9].

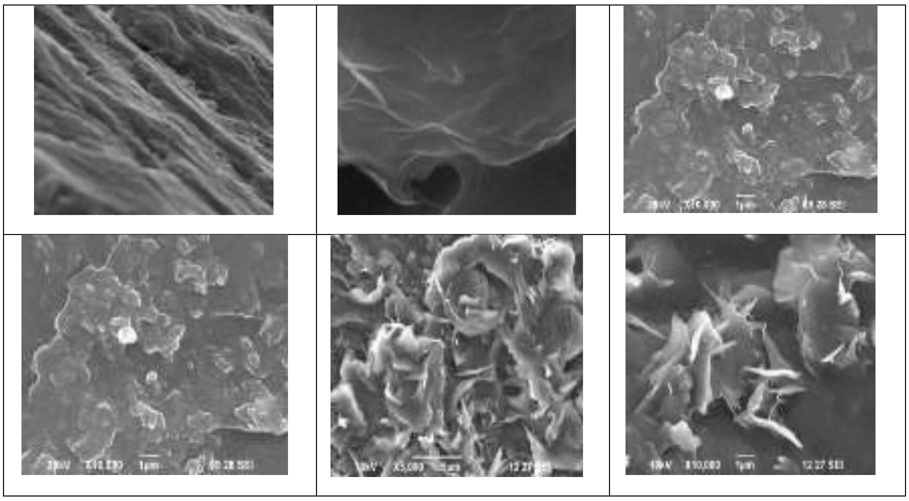


Figure 3.3: SEM photographs of (a) HWOP b) COP c) SKOP

3.5. DNA binding assay

UV-vis spectroscopy was used to investigate the binding of HWOP, COP and SKOP composites with CT-DNA [10]. A solution of CT-DNA in the buffer gave a ratio of UV absorbance of about 1.9 at 260 and 280 nm, indicating that the DNA was sufficiently free of protein. Absorption spectra and Plots of [DNA] / (ε_a-ε_f) versus [DNA] of HWOP, COP and SKOP was given in Figures 3.4.

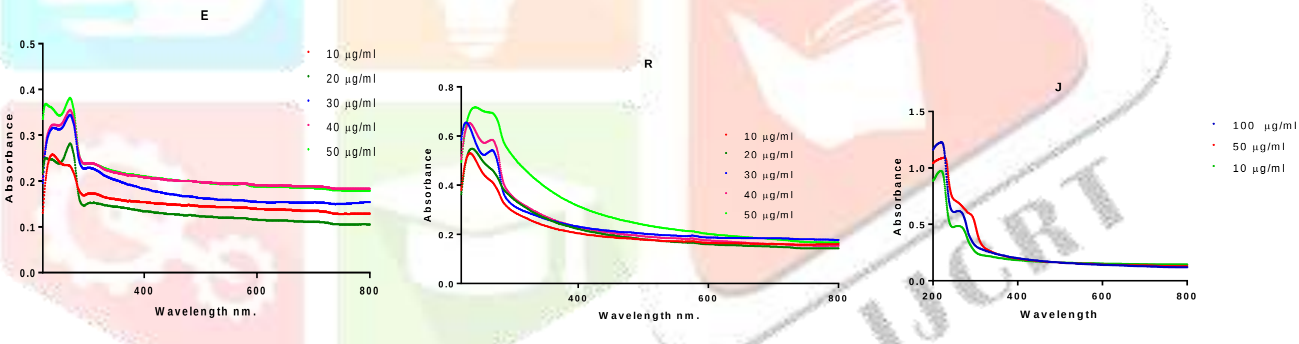


Figure 3.4: Absorption spectra of HWOP/COP/SKOP

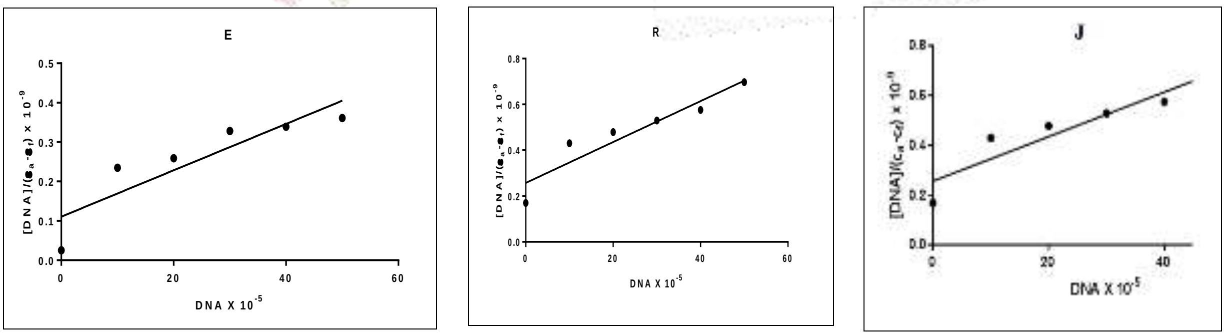


Figure 3.5: Plots of [DNA] / (ε_a-ε_f) versus [DNA] of HWOP, COP and SKOP

The intrinsic binding constant K_b of the HWOP, COP and SKOP with CT-DNA was 2.689 x $10^{4,}$ 3.717 x 10^4 and 3.132 x 10^4 respectively. The binding constant K_b suggests that a strong binding exists between polymers and CT-DNA . On comparing the polymers with CT-DNA, the binding constant of COP showed the strong binding than the other polymers.

4. Conclusion

We have synthesized polymers from non-edible oils in which characterized by using UV, IR. Degradation studies show that they are biodegradable. They exhibited cytotoxic properties and could be applicable against rapidly multiplying tumor cells. They showed a strong binding between the polymer and CT-DNA. K_b values show that comparatively COP can bind very strongly with DNA. These bio –based polymers are used as transparent tapes for labeling and packaging, reusable tapes, and flexible electronics, such as displays, semiconductors, and solar cells, as well as medical and pharmaceutical devices such as skin wound care treatments and biological adhesives.

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