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FORMULATION OF KAPPA-CARRAGEENAN AND GELATIN BLEND FOR CHEMICAL ANALYSIS AND MORPHOLOGICAL STUDIES

AHUJA S*, PATEL K AND RAULJI HJ

Department of Chemistry, Faculty of Applied sciences, Parul Institute of Applied Science, Parul University Limda-391760 Waghodiya, Vadodara, Gujarat. India

***Corresponding Author: Dr. Sonam Ahuja: E Mail: sonam.ahuja82106@paruluniversity.ac.in**

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ABSTRACT

Help of the two different natural biodegradable polymers (K-car/Gt) successfully create a different type of ratio film for using in food industries for packaging material. By using various types of analysis like FTIR, XRD, SEM, TGA for checking purity of compound, thickness of film, thermal stability of material, surface morphology etc. Further, Adusa leaves extract loaded biopolymer (KCGT) film of antibacterial study done by Disk Diffusion Method. The result revealed that KCGT composite film had excellent antibacterial study against *E coli* and *Staphylococcus organism*. By using a UV-spectra determine the concentration of molecule in the sample of Adusa leaves & KCGT loaded film have outstanding antibacterial and antioxidant behavior they allowed them to use for in polymer industries and food packaging & preserving material in food industries.

Keywords: Kappa-carrageenan, Gelatin, FTIR, XRD, TGA, SEM, UV-spectra, Antibacterial, PF study, WVT

1. INTRODUCTION:

Most of us have probably noticed that when we dump household solid waste at dumpsites, some of the garbage (biodegradable wastes) disappear after a few days while other rubbish (non-biodegradable wastes) begins to accumulate at the location. Biodegradable polymers are those that can degrade within a few days and are broken down by microbes.

The partial or complete hydrolysis of collagen results in the production of gelatin, a tasteless, colorless, water-soluble protein **[1]**. In general, biopolymers are utilized as thickeners, stabilizers, fat substitutes, taste-releasing agents, and structural elements in a wide range of applications. In food applications, biopolymers are combined with water, minerals, vitamins, fat, and oftentimes, more than one type of biopolymer. Mixed biopolymer systems are crucial because it is possible to regulate physical properties more precisely **[2]**. In the manufacture of capsules, gelatin has been a common raw material utilized in the pharmaceutical industry. It has good film-forming properties, is highly soluble in water at concentrations of around 60 °C, gels when cooled to ambient temperature, and dissolve readily at a temperature near to that of the human body **[3]**. A family of polysaccharides known as carrageenan's, commonly referred to as carrageenin's, are obtained by extracting several types of red seaweed. A combination of linear, sulfated, water-soluble galactans makes up carrageenan. This structure consists of a repeating pattern comprising 3,6-anhydro-galactose (3,6-AG) and d-galactose units linked together through both 1,3- and 1,4-glycosidic bonds in an alternating fashion. Greek prefixes like, and sulfate levels between 22% and 35%, are used to denote the many forms of carrageenan that have different characteristic structures. While λ-carrageenan function as a substance that enhance thickness or elevate viscosity, l- and k-carrageenan are carrageenan's that create gels. Water-soluble, hydrophilic linear colloid polymers are known as carrageenan's. Because of their helical nature, they are very flexible. Even at room temperature, they can form gels, yet they are poorly soluble in acids. Sulfate half-ester is present in these high-molecular-weight polysaccharides, which strongly anions carrageenan. When cations like calcium, sodium, and potassium are present, they begin to gel. In contrast to -carrageenan, which produces clear gels, the former is turbid (cloudy) **[4]**. Since the beginning of time, people have used medicinal plants to treat illnesses. Compared to synthetic treatments, plant-based medications are seen to be safer to use and have fewer negative effects. Since ancient times, plants have remained to be a major source of therapeutic chemicals that are essential to the preservation of human health. Unani, Siddha, and Ayurvedic remedies use the well-known Acantharean plant Adusa (Adhatoda vasica Nees) as an active ingredient. Its names in unani medicine are Adusa or Bansa. For treating colds, coughs, for treatment of pertussis (whooping cough),

persistent bronchial inflammation (chronic bronchitis), asthma, and the leaves, flowers, fruits, and roots are often utilizing for their properties, acting as a calming agent to alleviate symptoms, facilitating the expulsion of mucus, reducing spasms, and combating parasitic worms. The medication is used in a variety of ways, Including fresh juice, a decoction, an infusion, and a powder. It can also be obtained as syrup or an alcoholic extract **[5]**.

2. Material & Methods:

2.1 Material: Gelatin was purchased from PRABHAT INDL. ESTATE. ESTATE, DAHISAR (E), MUMBAI(INDIA). K-carrageenan was bought from SISCO RESEARCH LABORATORIES PVT. LTD, TALOJA, MAHARASHTRA(INDIA).

2.2. Method

2.2(a). Formulation of k-carrageenan:

The k-carrageenan film was made by combining 1g of the substance with 50ml of distilled water, heating it for 15 to 20 minutes at 40 to 50°c under magnetic stirrer. After the solution had been dissolved, they were kept heated at room temperature for some time.

2.2(b). Formulation of gelatin:

To make the gelatin film, 4gm of gelatin solution was prepared by dissolving it in 30ml of distilled water, followed by the application of heat for 20-30 minutes at 40 to 50°C while stirring. At room temperature, the solution dissolved while being stirred.

2.2(c). Formulation of k-carrageenan and gelatin composite film:

In a similar manner, K-carrageenan and gelatin are measured precisely at 100:0, 70:30, 60:40, and 50:50, respectively, and are added to various beakers and mixed until the combination is uniform in nature. The mixture was removed from the beaker and put into 4 individual petri dishes, where it was dried in the oven for two to three days before being removed.

2.2(d). Extraction of natural drug (Adusa):

At 45°C, Adusa leaves were dried in an oven. Using a grinder, the dried leaves were ground into powder. The powder that was produced in this way was extracted using a hydro-alcoholic mixture of methanol, ethanol, and water. At various concentrations of methanol, 10g of sample powdered substance was extracted with 100 ml of hydro alcohol solvent. remain for 2 to 3 days. Then separate the mixture using a filter, then collect the filtrate **[5]**.

2.2(e). Preparation of drug loaded film:

Take a ratio of k-carrageenan-Gelatin (70:30) blend and add 2 to 4 ml of drug extraction to it. Stir at 40° to 50°C and warm at room temperature before transferring it to a petri dish and drying it in an oven for 2 to 3 days.

After the drying process, remove the petri dish from the oven.

3. Chemical analysis

3.1 Swelling study test:

A pf solution was made by mixing 8.307 g of Nacl and 0.367 g of $CaCl_2$ in 1 lit of distilled water to create a swelling test for composite film. All ratio films were now cut into little pieces and weighed separately. The films were submerged in the PF solution, dried on filter paper at various intervals, and weighed. This procedure was used repeatedly throughout the course of the day. The following equation is used to calculate the pf swelling ratio:

$$SR = (Mt-Mo)/Mo \quad g/g$$

where Mo = original mass, Mt = The mass measured at various points in time.

3.2 WVTR test (Water Vapor transmission rate):

The WVTR was carried out using the manner below. take different sample films in reusable cups that have 20ml of distilled water in them. Using cello tape, tap the sample film and the mouth of the cup. The film has an effective area of around 4.5×10^{-4} m^2. At a certain moment, the cup was removed, and the film was immediately weighed on a digital scale. Continue doing this for 10 to 15 days **[9]**.

$$MVTR = \frac{24m}{a\Delta t}$$ **[9]**

Where, M= loss of water (gm), Δt = time duration, a = Effective transfer area per m^2. **[9]**

4. Characterization:

4.1. UV spectroscopy: UV-Visible's Basic Concept, the fundamental principle of spectroscopy is that chemical compounds absorb ultraviolet or visible light, creating unique spectra in the process. The interaction of light and matter is the foundation of spectroscopy. The study of UV radiation absorption, which has a wavelength range of 200–400 nm, is the focus of UV spectroscopy.

4.2. TGA analysis: To assess the resistance of material to thermal degradation or evaluate their ability to withstand high temperatures, particularly polymers, thermogravimetric analysis (TGA) is a potent approach. By measuring weight variations when a specimen's temperature rises, this approach measures weight changes in specimens. TGA can be used to measure the volatile and moisture contents of a sample **[6]**.

4.3. SEM analysis: Surface structure on a microscopic scale is observed by using SEM. Scanning electron microscopy (SEM) stands as a valuable method for examining the attributes of polymer surfaces, and indeed, any surface capable of withstanding a vacuum environment. Nearly all SEM procedures commence by depositing a thin layer of gold metal onto the surface, a step taken to ensure

the surface's conductivity—a fundamental necessity for SEM analysis. SEM entails the precise concentration of an electron beam into a slender probe, which systematically traverses the surface of the subject material. The interaction between this beam and the material results in the emission of electrons and photons upon penetrating the surface. These emitted particles are then captured by specialized detectors, offering insights into the surface's properties. The ultimate result of this electron beam's interaction with the sample's surface topography is the generation of an image that faithfully represents the surface's characteristics **[6]**. Scanning electron microscopy (SEM) was used to examine all the generated samples to investigate the surface morphology of these polymer electrolytes **[7]**.

4.4. XRD analysis: X-rays, a form of electromagnetic radiation with a shorter wavelength, are generated when energetic electrons slow down & enter the inner electron shells of atoms. Polymer scientists utilize X-ray diffraction (XRD) analysis to examine solid-state structural traits such crystallinity and amorphous polymeric and composite materials **[8]**.

4.5. FTIR analysis: Fourier-transform infrared spectroscopy is widely used to study the vibration of molecules in polymers. FTIR spectroscopy relies on the way that infrared light modifies molecules' dipole moments, which are related to a certain vibrational energy. The vibrations are particular to each functional group since they are made up of various atoms and bond strengths, such as the O-H and C-H stretches, which appear at about 3200 cm-1 and 2900 cm-1, respectively. These absorption bands can be used to identify molecules using library databases since the collection of the vibrational energy spectrum for every functional group in a molecule is distinct. Additionally, when all functional groups are joined, each one has a distinct vibrational energy that can be used to identify a molecule. Numerous benefits of FTIR include its improved signal-to-noise ratio, simultaneous detection of all wavelengths, speed of analysis, and sensitivity in addition to its increased light throughput **[8]**.

4.6. Antibacterial study: The loaded Gelatin/K-carrageenan composite film's antibacterial potency was evaluated using Adusa leaves. To dissolve 2.9 g of nutritional agar in a flask, add 100 ml of distilled water. Cleanup is required for the flask and Petri dish. Allow the media to cool to room temperature before spreading the E. coli test organism onto the solidified agar solution. A portion of the composite film is laid over a petri dish containing agar media and placed in

a controlled environment for cultivation maintained at temperature 36°C continuously over a span of 24 hours. The zone of inhibition should be located the following day.

5. Result of chemical analysis

5.1. Pf study test: Swelling is defined as an increase in the volume of a solid or gel due to the absorption of a liquid. The swelling study was carried out according to the following process. A pf solution was made by mixing 8.307 g of Nacl and 0.367 g of Cacl2 in 1 lit of distilled water. A solution is ready to use for the swelling study. Gelatin/carrageenan film was dip in pf solution for 30 minutes and take it out from this and dried it and weight it. then repeat the process 3 to 4 times.

SR = (Mt-Mo)/Mo g/g

where Mo = initial mass and Mt = mass at different time intervals.

As a result, plots of Swelling ratio(g/g) vs Time (t) for a sample **Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50)** graph shown in **(Figure 1)** and parameters given in **Table 1**.

Table 1: The pf study of films is Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50)

Time(min)	Car/Gt (100/0)	Car/Gt (70/30)	Car/Gt (60 /40)	Car/Gt (50/50)
0	0	0	0	0
30	6.33	23.25	1.98	3
60	8.11	27.75	2.26	3.36
90	9.55	30.5	2.96	3.52
120	10.8	32.75	3.27	3.95
150	11	34.25	3.43	4.25
180	12.33	35	3.5	4.74
210	12.55	35.5	3.6	5.01
24hr	17.88	39.75	3.66	6.52

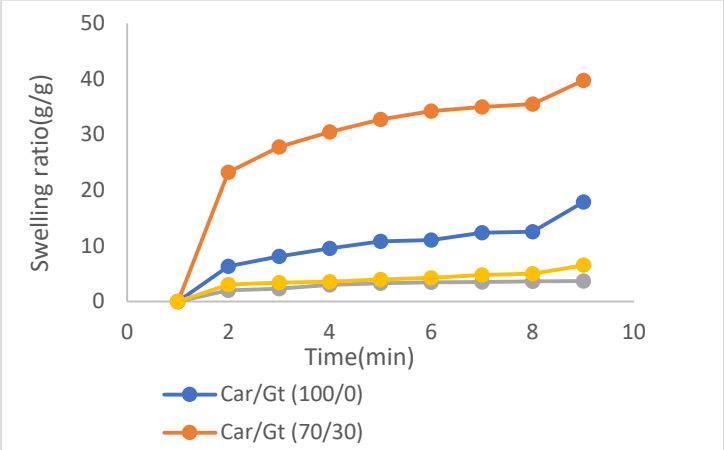

Figure 1: Plot graph between swelling ration vs Time

The result shows that sample of Car/Gt (70/30) absorbed a high pf solution than the other samples and sample Car/Gt (60/40) absorbed a low pf solution than the other sample.

according to power function law' which describes fractional water uptake as a time-dependent phenomenon.[10]

$\frac{Mt}{M\infty} = k\ t^n$ **[10]**

Where, Mt and M are the masses of the enlarged film at time t and in the actual dry state, respectively. k and n are the swelling exponent and film characterization constant, and the logarithmic version of the equation is **[10]**,

$\ln F\ (M_t/M_\infty) = \ln k + n \ln t$ **[10]**

As a result, plots of ln Mt /M∞ vs lnt for sample **Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50)** graph shown in **(Figure 2)** and different parameters given in **Table 2**.

Table 2: Data displaying lnF against lnt values at various time for different samples Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50)

	ln Mt/M∞			
ln t	**Car/Gt (100/0)**	**Car/Gt (70/30)**	**Car/Gt (60 /40)**	**Car/Gt (50/50)**
3.4	**-0.9**	**-0.5**	**-0.5**	**-0.7**
4.1	**-0.7**	**-0.3**	**-0.2**	**-0.7**
4.5	**-0.5**	**-0.2**	**-0.2**	**-0.7**
4.8	**-0.5**	**-0.2**	**-0.1**	**-0.5**
5	**-0.5**	**-0.1**	**-0.1**	**-0.4**
5.2	**-0.4**	**-0.1**	**0**	**-0.4**
5.3	**-0.4**	**-0.1**	**0**	**-0.2**

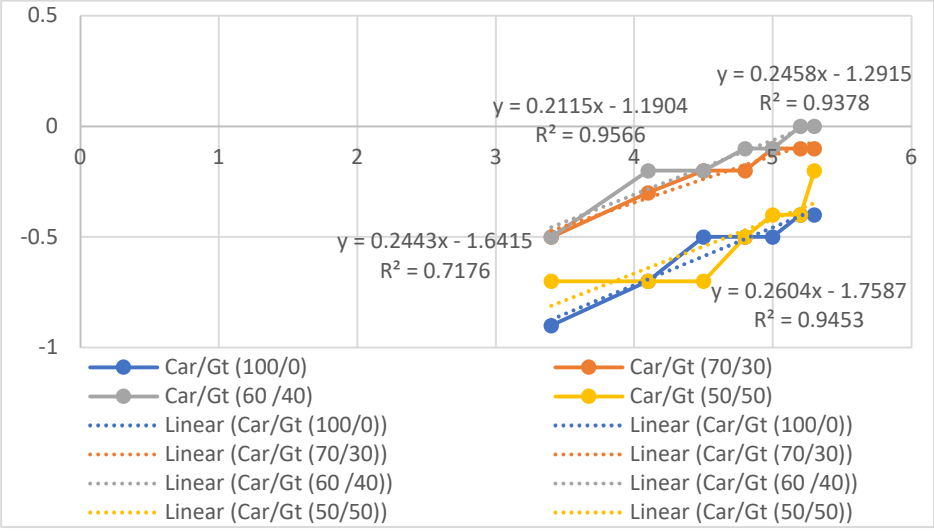

Figure 2: Plot graph between ln Mt/M∞ vs Time

The rate of water absorption is provided by the first-order kinetic model as follows **[10]**.

$dMt/dt=k_1 (M_\infty-M_t)$

where, k1 = first-order rate constant **[10]**.

For, integration of the above equation has a limits t=0, Mt=0 and t=t, Mt=Mt, we get,

$\ln (1-Mt/M\infty) = -k_1.t$ **[10]**

As a result, plots of ln (1Mt /M) vs t should be linear with a slope of k1 show in (fig.3) and parameters given in **Table 3 [10]**.

Table 3: Data on first order of kinetics for different samples Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50).

	Ln(1-Mt/M∞)			
Time(min)	**Car/Gt (100/0)**	**Car/Gt (70/30)**	**Car/Gt (60/40)**	**Car/Gt (50/50)**
0	**0**	**0**	**0**	**0**
30	**-0.4**	**-0.6**	**-0.6**	**-0.5**
60	**-0.5**	**-0.7**	**-0.8**	**-0.5**
90	**-0.6**	**-0.8**	**-0.8**	**-0.5**
120	**-0.6**	**-0.8**	**-0.9**	**-0.6**
150	**-0.6**	**-0.9**	**-0.9**	**-0.7**
180	**-0.7**	**-0.9**	**-1**	**-0.7**
210	**-0.7**	**-0.9**	**-1**	**-0.8**

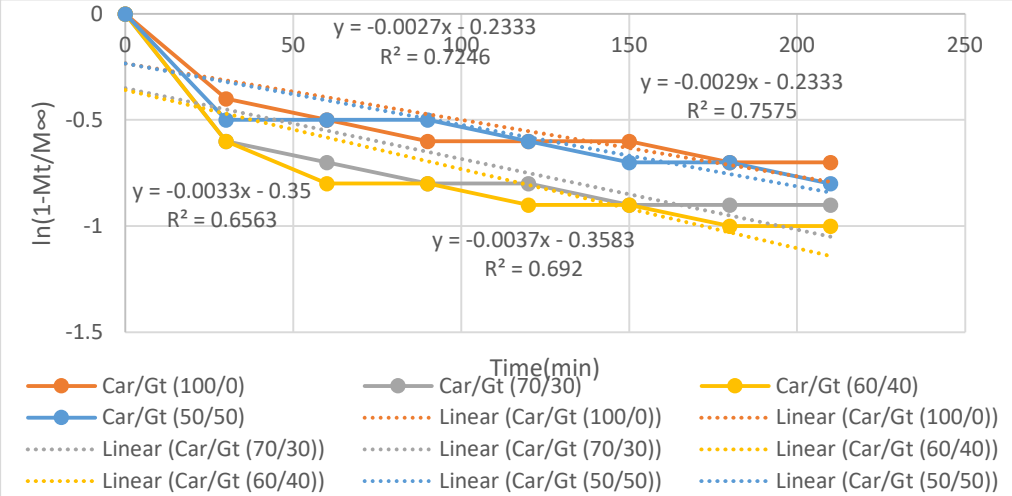

Fig.3 plot graph between ln(1-Mt/M∞) vs Time

the swelling capacity prior to reaching equilibrium **[9]**.

$$dMt/dt = k2(M\infty - Mt)\ 2$$

where 'k2' = kinetic second order rate constant for swelling. Integration of above equation:

$t/Mt = 1/ k2M2 \infty + t /M\infty$

$Lt \frac{Mt}{dt} = \frac{1}{A}$ $t \rightarrow 0$

The initial swelling rate is inversely related to the intercept A. The kinetic rate constant K2 according to be Schott method is determined to be: **[9]**.

$$k2 = \frac{slope^2}{intercept} = \frac{B^2}{A}$$

As a result, plots of t/mt vs t for sample **Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50)** graph show in **(Figure 4)** and different parameters given in **Table 4**.

Table 4: Schott model for different samples Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50).

	t/mt			
t	Car/Gt (100/0)	Car/Gt (70 /30)	Car/Gt (60/40)	Car/Gt (50/50)
30	45.5	30.9	19.7	39.5
60	73.2	52.2	32.4	74.1
90	94.7	71.4	44.6	105.9
120	112.1	88.9	55	129
150	128.2	106.4	66.4	153.1
180	150	125	78.3	165.1
210	172.1	143.8	89.4	184.2

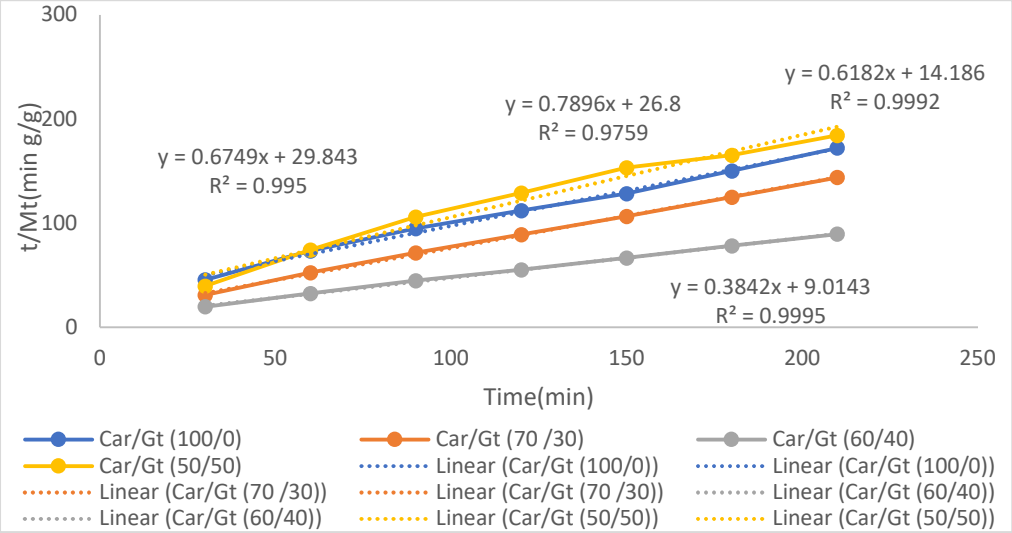

Figure 4: Plot graph between t/Mt vs Time

Table 5: Data for various film sample Car/Gt (100/0), Car/Gt (70 /30), Car/Gt (60/40) and Car/Gt (50/50)

	moisture loss(g)			
Time	car/gt 100/0	car/gt 70/30	car/gt 60/40	car/gt 50/50
0	0	0	0	0
24	0.263	0.111	0.175	0.176
48	0.564	0.254	0.434	0.385
72	0.835	0.419	0.635	0.573
96	1.085	0.533	0.833	0.764
120	1.35	0.641	1.021	0.945
144	1.645	0.811	1.253	1.197
168	1.875	0.913	1.374	1.286
192	2.136	1.113	1.566	1.466
216	2.34	1.303	1.755	1.787
240	2.38	1.506	1.952	2.003
264	2.421	1.626	2.311	2.057

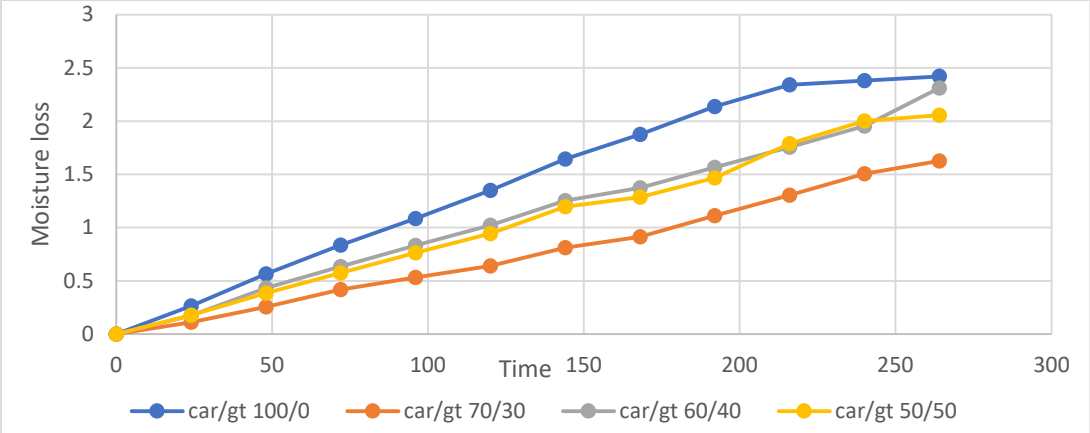

Figure 5: plot graph between moisture loss vs time

6. Result of Characterization

6.1. UV spectroscopy: A common analytical method in chemistry, biology, and physics is UV-visible spectroscopy. It involves measuring the wavelength-dependent absorption of ultraviolet (UV) and visible (VIS) light by a material. The electrical structure and concentration of molecules in a sample may be determined using this method. The spectrum can be created by measuring the Adusa absorbance throughout a range of UV-visible wavelengths, generally from 190 nm to 800 nm. According to the graphical interpretation Adusa UV spectra appears at wavelength of 443. 00nm.The result shown in **Figure 6**.

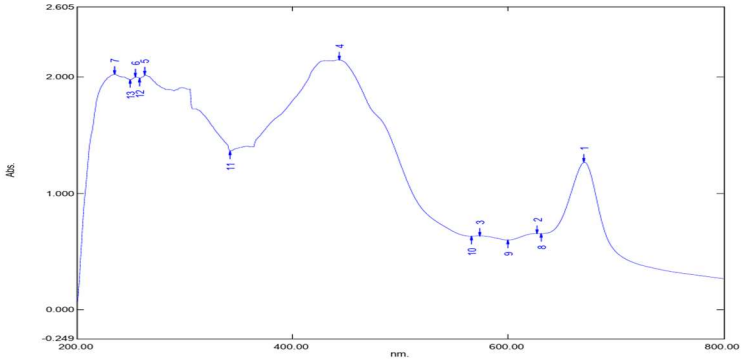

Figure 6: UV spectra of vasaka (Adusa) drug

6.2. TGA analysis: The given data seems like a series of temperature (°C) and composition (%) measurements at different points during a heating process. This process goes ahead at an initial temperature of 25.00°C and continues up to 800.00°C at a rate of 10.00°C per minute. The sample's weight was noted down as 11.022 mg at the start of the experiment. At 34.17°C, the sample's composition was measured to be 98.66%. The composition

changed by 14.191% as the temperature increased however the data contain an error, denoted by "0/0". Further with this process, temperature increased to 109.03°C, change in a composition of sample was 84.470%. as temperature continuously increased at 221.33°C with composition of sample changed by 78.425%. composition of sample changed was noted down at point of 19.359%. further moved in this process increased with a temperature at 226.68°C, changed in composition of sample was 59.066%, and at 229.88°C, it was 58.585%. composition of sample changed was noted down at point of 14.048%. the temperature reached at 259.83°C, and changed in composition of sample was 44.537%, at the same time 268.39°C temperature, changed in composition of sample was 43.975% and change in composition at some unknown temperature measured at 30.205%, with continued to increase in temperature. Further the data was measured at 653.41°C with a compositional change of 13.770%. In graphical representation temperature ranges from 100 to 792.1°C on the x-axis. Graphical representation was shown in **Figure 7**.

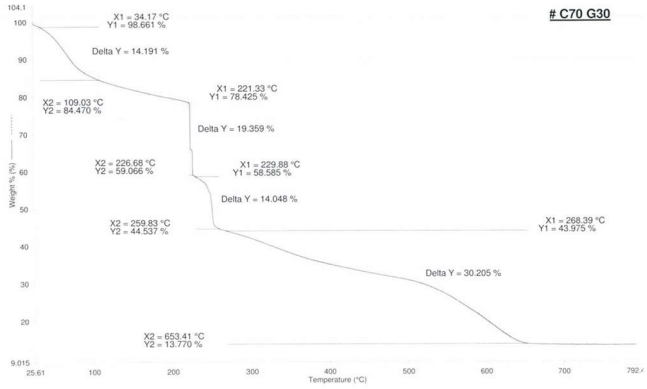

Figure 7: TGA graph of sample k-carrageenan/Gelatin (70:30)

6.3. SEM analysis: The microstructure and surface morphology of materials, including mixtures of polymers like kappa-carrageenan and gelatin, may be examined using scanning electron microscopy (SEM), a potent imaging tool. SEM analysis of such mixtures can yield important information on the physical composition and interactions of the constituent parts. Scan the film's surface with the electron beam. High-resolution pictures from SEM will show the film's microstructure and surface morphology. Take pictures at various magnifications to get a full understanding of the microstructure of the film. Analyze the SEM pictures to comprehend the microstructure of the film,

including the positioning and interactions of the kappa-carrageenan and gelatin inside the film. Aspects like layer thickness, particle distribution, and surface properties may be evaluated with the use of SEM **[12]**.

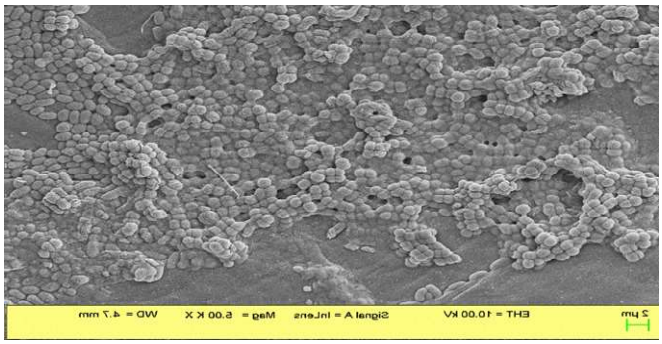

Figure 8: image of SEM for the k-carrageenan/Gelatin film surface

6.4. XRD analysis: XRD is a powerful analytical technique which is used in chemistry, material science and physics field for identification and investigation for crystallography of different materials. With the use of X-ray diffraction, experts may examine the atomic and molecular structure of crystalline materials to better understand their characteristics and behavior. A peak was seen using an X-ray diffractometer. a combination of k-car/Gt film spectra shown below in **Figure 9 [13]**.

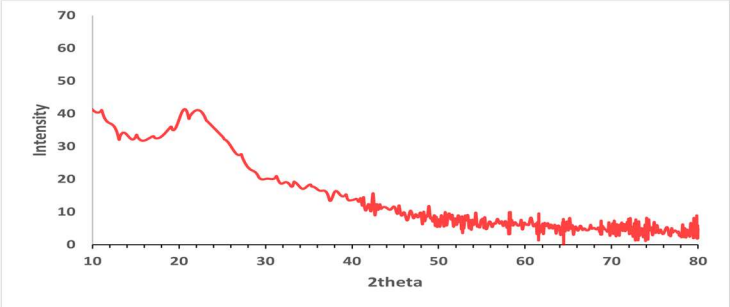

Figure 9: XRD graph for sample k-car/Gt (70:30)

6.5. FTIR analysis: Fourier-Transform Infrared Spectroscopy is referred to as FTIR. It is a potent analytical method used in chemistry and materials science to identify and investigate the chemical composition and structure of a variety of compounds. The molecular structure and properties of both individual ingredients, such as kappa carrageenan and gelatin, as well as their mixes, may be examined using FTIR spectroscopy. It is possible to identify the chemical structure of kappa carrageenan using FTIR. Carrageenan's distinct functional groups and molecular vibrations, such as its

sulfate ester groups and carbohydrate backbones, may be recognized using this technique. By comparing the IR spectra of the samples to a reference spectrum of pure carrageenan, FTIR may be used to evaluate the quality and purity of kappa carrageenan samples. The result of IR ranges shown in **Figure 10(a)**. In kappa-carrageenan such sulfate ester groups, and carbohydrate backbones are present in their molecule. A peak about 3351.11cm^{-1}of kappa carrageenan having a hydroxyl(O-H) stretching vibration. The O-H stretching vibration appear between 3200 to 3600 cm^{-1} range. Asymmetric stretching vibration of Sulfate (So_4^{2}) group appeared at 1409.43 cm^{-1} and symmetric stretching vibration of Sulfate (So_4^{2}) group appeared at 1035.92 cm^{-1}. Asymmetric stretching vibration of Sulfate (So_4^{2}) group range between 1000 -1200 cm^{-1} and symmetric stretching vibration of Sulfate (So_4^{2}) group range is 1200 – 1400 cm^{-1}. Asymmetric banding vibration of So_4^{2} group present at 849.55 cm^{-1} and symmetric banding vibration shown at 710.79 cm^{-1}.The result shown in **Figure 10(b)**. In gelatin such as a hydroxy (O-H) group, and the carbonyl(C=O) group, alkene(C=C), carbon-hydrogen group(C-H) are present. Hydroxyl group of stretching vibration present at 3279.55 cm^{-1} and the range is 3200-3600 cm^{-1}. C-H stretching vibration is present at 2926.36 cm^{-1} and its range is 2900-2960 cm^{-1}. A peak at 1629.87 cm-^{1} in the infrared spectra of gelatin commonly correlates to the amide(I) band. The stretching vibrations of the carbonyl (C=O) groups in the peptide bonds that connect the amino acids in the protein structure of gelatin are principally responsible for the amide I band and amide II band present at 1549.90 cm^{-1}. C-O stretching vibration is appeared at 1082.94 cm^{-1}.Result shown in fig.10(c). In k-carrageenan/Gelatin blend film O-H group of stretching vibration appeared at 3276.89 cm^{-1} and its range is 3200-3600 cm^{-1}. C-H stretching vibration peak present at 2924.78 cm^{-1} and its range is 2900-2960 cm^{-1}. Stretching vibration of carbonyl (C=O) present at 1632.78 cm^{-1} **[11]**.

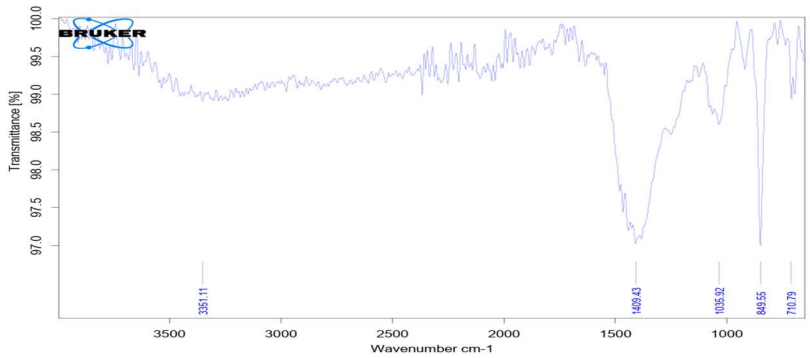

Figure 10(a): FTIR Spectra of kappa-carrageenan film

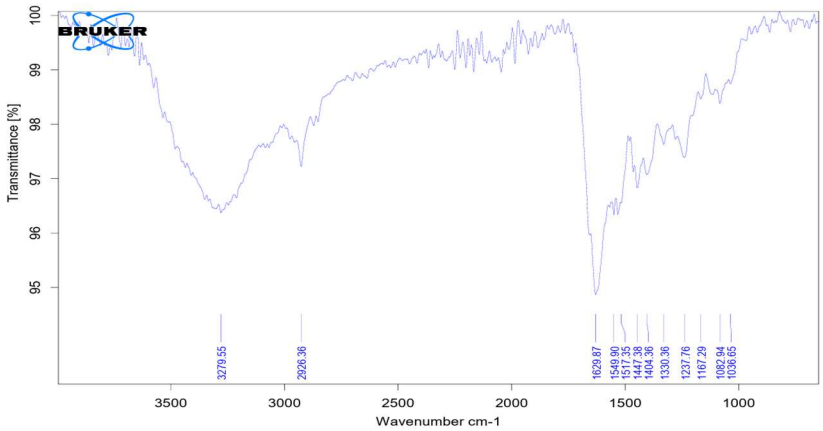

Figure 10(b): FTIR spectra of Gelatin film

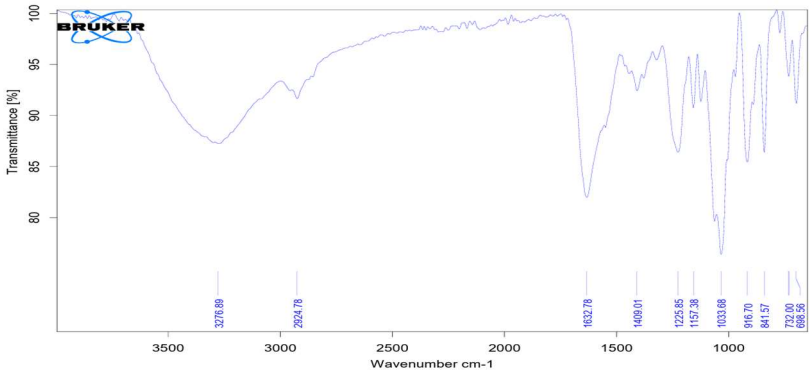

Figure 10(c): FTIR spectra of k-car/Gt (70:30)

6.6. Antibacterial Study: This Antibacterial study is performed by the disk diffusion method.in this process needs to grow any bacterial (*E. coli*) organism culture. culture filled in petri dish. Pouring a Adusa extract loaded composite film containing k-car/Gt (70:30) mixture. Use this process to determine the bacterial inhibition zone. This mixture can inhibit bacteria. Result shown in **Figure 11**.

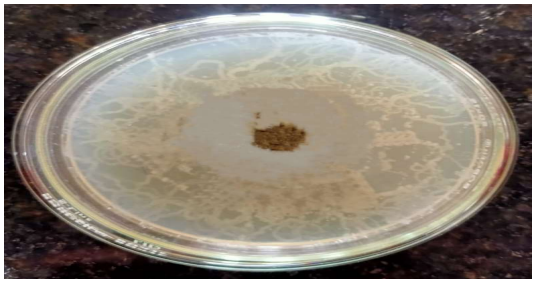

Figure 11: Antibacterial Study

7. CONCLUSION: A useful tool for generating desired texture, stability, and sensory qualities in a variety of food and medicinal items is the combination of kappa

carrageenan and gelatin. It is a desirable alternative for the business due to its blend of natural components, clean-label appeal, and functional adaptability. Future uses and formulations are likely to be even more novel if research and development efforts are made. Established k-car/Gt composite film may be used for food packaging materials and conservation. Use of the natural Adusa drug use for the medicinal purposes or use as a wound dressing material with drug loaded film of k-carrageenan/gelatin. gelatin and carrageenan have antibacterial properties and are used for the wound dressing material. Its biodegradable polymers which exist from natural source that's way it's not harmful for the nature of environment.

REFERENCES

[1] Luo. Q, Hossen.A. Md, Zeng.Y, Dai.J, Li.S, Qin.W, Liu.Y: Gelatin-based composite films and their application in food packaging: A review. Journal of Food Engineering.313,2022,110762.

[2] Khojah S.M: Bio-based Coating from Fish Gelatin, K Carrageenan and Extract of Pomegranate Peels for Maintaining the Overall Qualities of Fish Fillet. Journal of Aquatic Food Product Technology. 29(8),2020, 810-822.

[3] Zhu.F: Recent advances in modifications and applications of sago starch. Food Hydrocolloids. 98,2019,412-423.

[4] Bagal-Kestwal D.R, Pan.M.H and Chiang B.H: Properties and Applications of Gelatin, Pectin, and Carrageenan Gels [chap-6]. Bio monomers for green polymeric composite materials,2019,117-140.

[5] Ansari Z.Md, Sofi G.U, Uddin.H, Ahmad.H, Khan.I, Basri.R: Whole extract optimization of Adhatoda vasica, Nees leaf by using Response Surface Methodology (RSM). The Journal of Phytopharmacology.9(1),2020,24-29.

[6] Titus.D, E. James Jebaseelan Samuel, Selvaraj Mohana Roopan: Chapter-12-Nanoparticle characterization techniques. Green Synthesis, Characterization and Applications of Nanoparticles.2019,303-319.

[7] K. Sravanthi, Gunturi S.S, Erothu.H: Development of bio-degradable based polymer electrolytes for EDLC application. Optik- International Journal for Light and Electron Optics.241,2021,166229.

[8] Baidurah.S: Methods of Analyses for Biodegradable Polymers: A Review. Polymers. 14(22),2022,4928.

[9] Bajpai S.K, Chand.N, Ahuja.S, Roy M.K: Curcumin/cellulose micro crystal/chitosan films: absorption behavior and in vitro cytotoxicity. International Journal of Biological Macromolecules. 75(2),2015,239-247.

[10] Bajpai S.K, Chand.N and Agrawal. A: Microwave-assisted synthesis of carboxymethyl psyllium and its development as semiinterpenetrating network with poly(acrylamide) for gastric delivery. Journal of Bioactive and Compatible Polymers. 30(3),2015,1-17.

[11] De Alcântaraa M.G, de Freitas Ortegab. N, Souzab C.J.F, Garcia-Rojasa E.E: Electrostatic hydrogels formed by gelatin and carrageenan induced by acidification: Rheological and structural characterization. Food Structure. 24,2020,100137.

[12] Muthulakshmi. L, Kumar B.A, Rajasekar. A, Annaraj. J, Pruncu C.I: The benefits of k-Carrageenan-gelatin hybrid composite coating on the medical grade stainless steel (SS304) used as anticorrosive barrier. Materials Chemistry and Physics.258(3),2021,123909.

[13] Shujahadeen B. Aziz, Brza M. A, Nofal M.M, Abdulwahid R. T, Hussen S. A, Hussein A.M, and Karim W. O: A Comprehensive Review on Optical Properties of Polymer Electrolytes and Composites.Materials.13(17),2020,3675.