The effect of adding insecticide on the bonding temperature and the glass transition of poly (vinyl alcohol).

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Abstract: paper, polymeric films were prepared to repel insects. The main of using the polymer together with the pesticide is to reduce the effect of the pesticides on the environment and humans, The mixture of polymer and insecticide (Ikon, Izagata) is prepared by mechanical mixing (mechanical mixer), after which the samples are poured into a silicone mold, and left under normal conditions (36-48 hours) to dry and extract the membrane, After that, the required tests are conducted and the effect of the polymer on the pesticide and vice versa is done, By examining the FTIR, we know the change in the bond values. As for the economic feasibility, it is achieved to reduce pollution with pesticides by spraying on the one hand, and on the other hand, the polymer with the pesticide in a composite form works to kill insects and over time it is exposed to UV rays that break into the polymer and free the pesticide to work again

Keyword :. Polymer + Repellent (ikon ,izagata)

1. Introduction

In the past and until now, insects have spread widely, and the presence of insects represents a great danger to human life, as they are the main cause of transmission of many diseases, such as dengue fever, malaria and yellow fever. [1]. Its presence also pollutes food and the environment. Marcin Przybylak et al (2018) [2] conducted a study to treat cotton fabrics with a different type, Polysiloxanes, to transfer biocides and make them water resistant Polysiloxanes to impart water repellent properties and tested biocides to modified fabrics. By measuring the contact angle with water, the water resistance is determined. Samples were evaluated by SEM, FTIR Spectra and Elemental. The results showed that biocidal, waterproof and washable properties were obtained from the multifunctional fabrics. Modified samples show protection against mold growth at level 2 and water contact angle of up to 140 .

Synthetic insecticides have been used to solve this problem of all kinds [3]. However, these pesticides had a bad effect on human health and the environment on the other hand, as they may cause allergies and environmental pollution, in addition to infectious diseases, insect bites stimulate local bites, irritation and discomfort [4]. Some insects have become resistant to current synthetic repellents, and some pesticides have been banned due to environmental concerns. A number of researchers have used polymers with pesticides to reduce the dangers of the pesticide such as, Mostafa Mag Fouda et al. (2008) [5] used a mixture of a carbohydrate polymer with medicinal limonene and applied it to cotton fibres. The active result of their action is expressed in the biotoxicity of mosquitoes as a repellent. As a result of the bioassay, the handling values of the saturated fibers are almost equal to the black samples, and the cotton fibers were coated on one side with a polymer containing diffused pieces of limonene in cross section and good insect repellency was obtained.The medical importance of mosquitoes is mainly due to their ability to transmit many diseases such as fever and encephalitis [2]. Mosquitoes kill nearly 1 million people every year, and children are also affected by mosquito-borne diseases (2).

To solve this problem, the idea came to use biopolymers and to prepare environmentally friendly and insect repellent polymeric films. Also, the innovative product does not have any negative impact on humans, the environment, and foodstuffs. It is used at any time in malls, department stores, and butchers' stores.

In this study, a polyvinyl alcohol polymer was used for mixing with pesticides

as previous studies have proven that this polymer is the best polymer to mix with the pesticide because of the unique properties,]it possesses, the most important of which are biodegradable polymer(Which decomposes after performing the required function does not cause any harm to the environment) and Non-toxic and non-carcinogenic, Compatible with the environment and people, Colorless, water-soluble synthetic polymer, has good film-forming ability PVA undergoes esterification with both inorganic and organic compounds[7].

PVA is widely used as surface material, as films, and glues because of their biocompatibility, stability to" "temperature variation [8].encapsulated into the Nanofibers via electrostatic spinning. In the synthesis of polyvinyl alcohol (PVA) Nanofibers, namely the p-menthane-3,8-diol microcapsules, permethrin, chili, and catnip oil, the different repellants were electrically spun. Their findings showed that all insect repellants incorporated into the nanofibre structures reduce the negative of mosquito landings compared to the control group. As a result, the method currently described has resulted in a new and highly efficient tissue

material that can be used to avoid insects. The "water, which acts as a plasticizer, will then reduce" "its tensile strength, but increase its elongation and tear "strength.

Hebeish et al., (2014) [11] chemically treated the cotton fibers and filled them with methacrylate, and beta-cyclodextrin contains permethrin to provide defense against adult mosquitoes. They compared it with untreated fibers, it showed toxic and repellant effects to mosquitoes after 6 min and also after 24 hours.

2. Experimental Part

2.1Materials.

A-Poly vinyl alcohol (PVA)
vinyl alcohols properties maintain

Table (1) Poly vinyl alcohol Properties

Property""	"Data"
Color	white crystalline powder- flakes – granules
Solubility	4% solution in cold water is clear and colorless
Viscosity	27-30 cp aqueous solution at 20 ºC
Molecular weight	160000 (g/mol)
Degree of hydrolysis (%)	86.50-89.0

B- Repellent insertion (ikon , izagata)

1-Insecticide type Ikon

International health pesticide in the form of a powder that can be wet with water to be prepared in the form of an emulsion concentrate. Each 1 gram contains 100 grams of the pyrethroid compound lampdasylhothrin. The active ingredient α - is designed as a general insecticide for use in disease vector control through space spraying or use in public health pest control programs.

2-insecticide type izagata

An insecticide that contains the active ingredient thiamethoxam, as well as an attractant pheromone, which is sure to attract flies to any spot I use, This formula is used as a coating, where surfaces are painted with it and flies collect on these surfaces and die.

2.2 Preparation of solutions(PVA + Repellent)

In 250 ml of cold water, dissolve 20 grams of polyvinyl alcohol granules and place them on a sterer without heat and leave two hours for the polymer to dissolve well. The solution is wrapped and covered well and left for a whole day before mixing with the insecticide. Then we dissolve the insecticide (60 grams) in 1 liter of water. After completing the process of preparing and dissolving the polymer and the insecticide (Icon, izagata), we take 7 % of the polymer solution (PVA) and this amount remains constant and we add to it different percentages of the insecticide (Icon, izagata) with proportions (2,4%). After adding the insecticide to the polymer, it is mixed by a mechanical mixer at a speed (50) for one hour so that the polymer and pesticide are well combined.

Then pour the solution (polymer + insecticide) into a silicone mold and leave under normal conditions (temperature, humidity) for (36-48 hours) to dry, and obtain a sample for the required test

Table (2) Pesticide concentration and PVA

Sample	%	%
PVA pure	0	0
PVA + Izagata	2	4
Ikon +PVA	2	4

2.2.1 Preparing samples of the first type of pesticide (Izagata) with the polymer first and second spesmeint (PVA + Izagata 2 ,4 %)

In 70 ml or (7%) of the polymer solution (PVA) and add to it a percentage of (2, 4%) of the insecticide (izagata).After the pesticide is added to the polymer, it is mixed with a mechanical mixer at a speed (50 km) for an hour until the polymer and the pesticide are well combined. Then pour the mixture (polymer + izagata) into a silicone mold and leave it under normal conditions (temperature, humidity) for (36-48 hours) to dry, and obtain a sample for the required tests.

2.2.2 Preparing samples of the second type of pesticide (Ikon) with the polymer first and second spesmeint (PVA + Ikon 2 ,4 %)

in 70ml or (7%) of a polymer solution (PVA) and add to it a proportion (2,4%) of the insecticide (icon).

After adding the pesticide to the polymer, it is mixed with a mechanical mixer quickly (50 km) for an hour until the polymer and

the pesticide are well combined.

Then pour the mixture (polymer + izagata) into a silicone mold and leave it under normal conditions (temperature, humidity) for (36-48 hours) to dry, and get a sample to perform the required tests

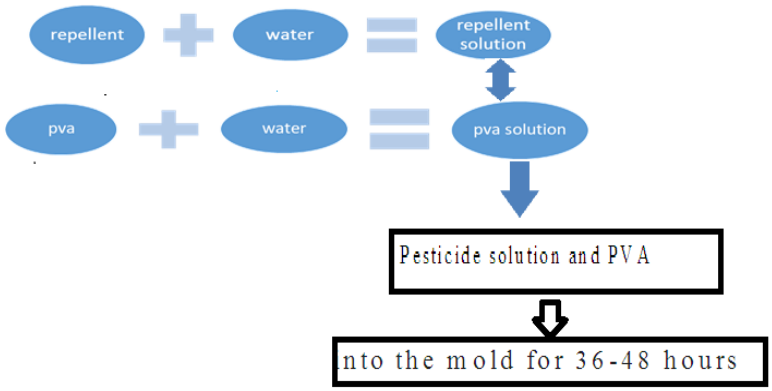

Figure 1 : sample preparation

2.3 Bioassay

A vertical landing bioassay was used to determine the possible repellence of the new incorporated repellence fabrics. The assay consisted of a cubic cage Dimensions of the cube (30 * 20 * 10 cm3) A substance is placed inside the cube to attract flies, such as (sugar) It is coated fr0m the inside with the liquid that contains the polymer and the insecticide and placed in a place containing insects 0r insects (flies) are placed inside it and leave a small 0pening in order to allow the insect to exit or expel and we watch the death of the insect or its expulsi0n and calculate the time, The temperature at the gauze was kept at 35 ± 2 °C, comparable to the temperature of human skin

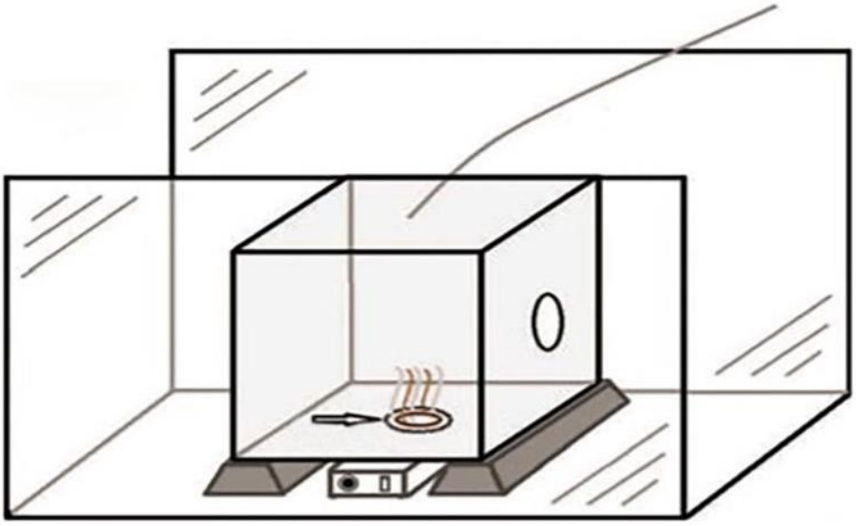

figure 2. bioassay

3. Characterizations.

Fourier transforms the infrared technology used to characterize the samples prepared using instrument type (IR Affinity-1) developed in the Department of Polymer and Petrochemicals (Kyoto Japan) Calibrate the unit using KBR to weigh a sample, and then prepare a powder from the sample to be analyzed and blend it with KBr mixing ratio 99 percent KBr. A diagram between the permeability or absorption and the number of waves that indicate the chemical composition of the material is given by the FTIR spectrum. This test was carried out in conjunction with ASTM E1252for PVA and PVA/repellent to determine if there is a chemical or physical bond between the polymer and the filler. This technique was also used to classify the substance of propolis (P), By using the technique of atomic force microscopy (AFM), topography and other surface properties can be determined, The AFM theory is based on mechanical contact between the sample surface and the tip; the nano-scale particle measurement is therefore highly influenced by the interaction of the surface sample-tip. Morphological investigations were conducted in the laboratories of the Department of Polymer and Petrochemical Industries for pure material and nanocomposite material by tapping

model AFM (AA3000) In the laboratories of the polymer and petrochemical industries department. The heat transitions, entropy, real heat, and enthalpy are calculated by this unit,This test was performed using the SH1MADZ-4 DSC-60 system as per ASTM D3418-o3. In the form of a sheet weighing 0.004 g, samples of (PVA) and (PVA / Repellent,) were compressed in the pan and put in the testing unit. The samples were measured with an mm heating range from RT to 250 C under nitrogen gas and a heating rate. UV-Visible-CECIL 2700 computerized spectrophotometer, is used to determine the absorption of light from a sample. The sample is placed in a specific position of UV / VIS. A double beam. Two beams of light are used by the spectrophotometer: a reference beam and the sampling beam through which the sample passes. Spectra is all spectra. In a cell made of quartz, measured at room temperature with an optical Length of path: 1cm. This test was conducted on the water inside the envelopes, This test was conducted in compliance with ASTM E 3088 E.

4. Results and Discussion

4.1 bioassay

The Bioassay experiment was a fatal blow to insects (flies) after coating a glass cube with polymer with the insecticide, releasing flies inside the cube, and counting the time when the insects died or were expelled. The time was 1-3 minutes. We got rid of the flies completely. We can conclude from this that the pesticide long with the polymer served the required purpose, which was to repel insects and kill them in a very short time.

4.2 Visible of the PVA , PVA Repellent (Ikon, izagata)

The visible UV spectrum of pure PVA shows the absorption of n a (275-295 nm),When adding the insecticide, we notice a change in the composition as a result of the reaction, and this leads to an increase in the absorbance with wavelength towards the visible light region (380-780 nm). When adding the first type of insecticide (izagata), the electrical gap card changes, causing it to absorb a wide spectrum of rays,The transmittance is 60%, and this indicates that the prepared film reduces the transmittance to light.

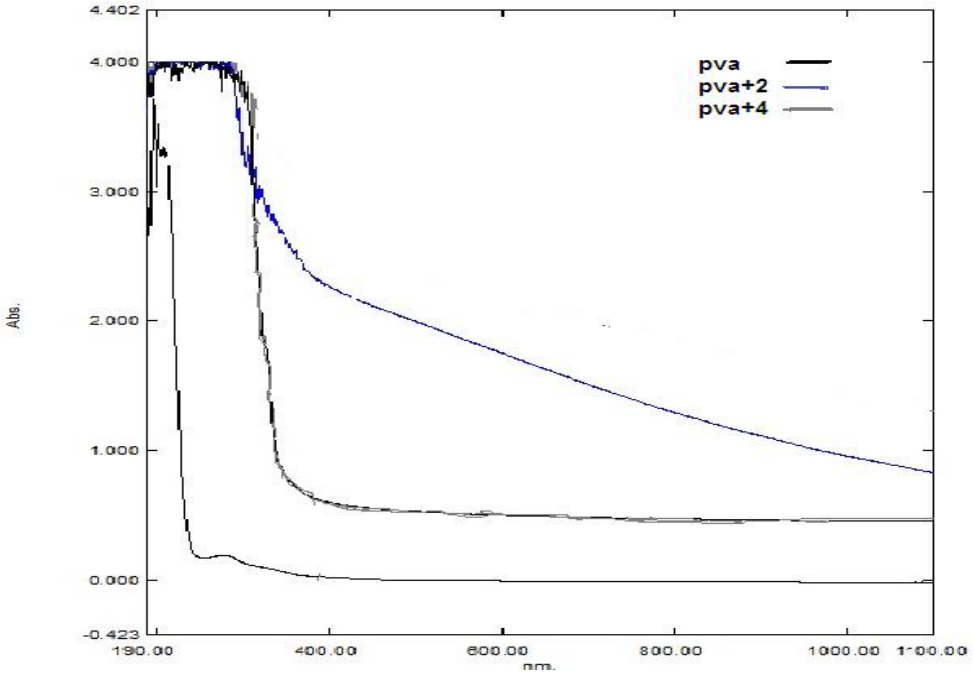

Figure 3: UV analysis of PVA+ izitaga

When the second types of insecticide (Ikon) is added , there is less change in the electrical gap and energy absorption up to 400 nm, and the permeability is very high, up to 90%, as in the below, figure(4)

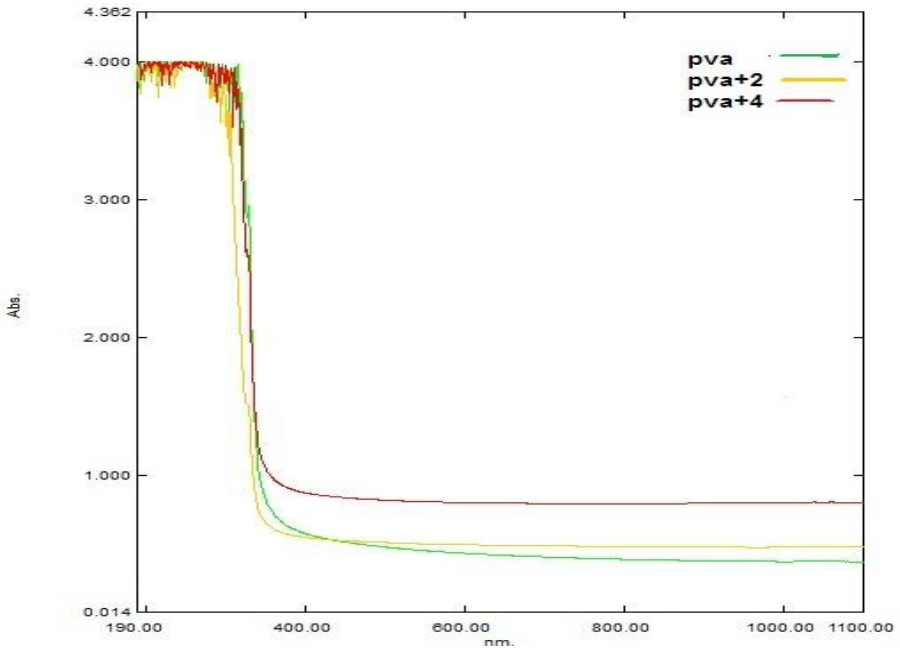

Figure 4: UV analysis of PVA + ikon

4.3 DSC Analysis of the PVA , PVA Repellent (Ikon, izagata)

When adding the second type of insecticide (Ikon), there is less change in the electrical gap and energy absorption up to 400 nm, and the permeability is very high, up to 90%, as in the below, figure (4)

Table (2) thermal properties of PVA and PVA with repellent(ikon ,izagata)

	Sample				
	Pva pure	*Pva+2% izagata*	*Pva+4% izagata*	*Pva+2% ikon*	*Pva+4ciikon*
TG	*87.29*	*108.59*	*97.14*	*92.15*	91.48
TM	*188*	*192.04*	*200.10*	*191.57*	*192.41*
Degradation	*230*	*240*	*248*	*250*	*248*

We note from the above table that adding the insecticide in general leads to an increase in TG, TM, and the temperature of decomposition. We conclude that the insecticide acted crosslink with the polymer and was bound by strong bonds (hydrogen bond),The presence of hydrogen bonds leads to an increase in (TG),TM and the temperature of decomposition and TG increase when adding the insecticide (Ikon and Izagita) a%ording to the above ratios as shown in table (2).

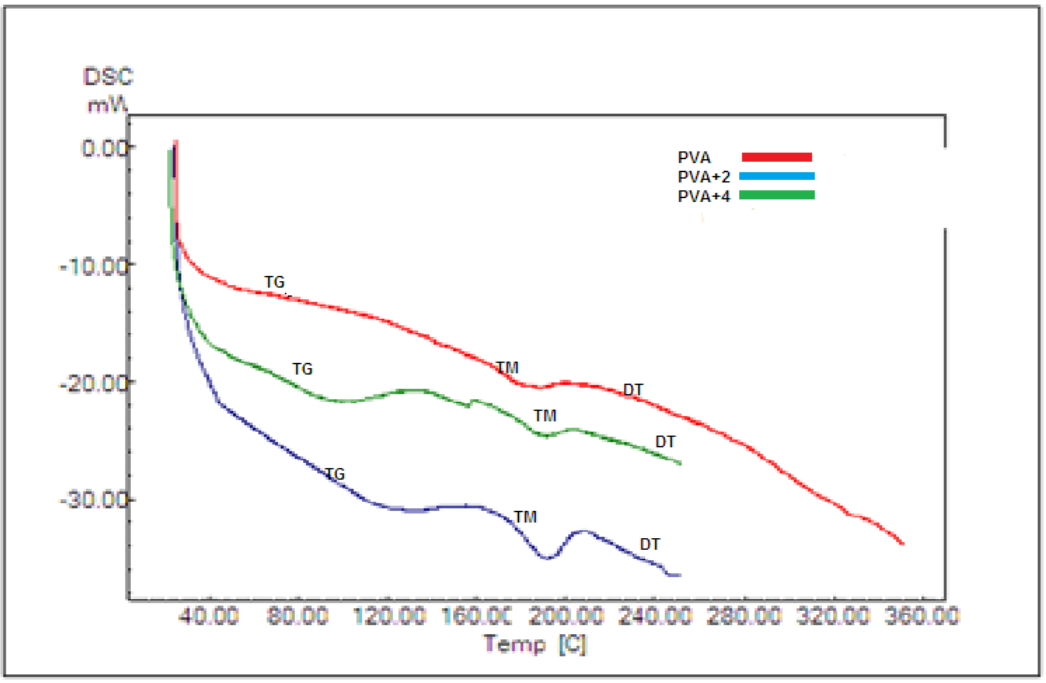

Figure 5: DSC of PVA+ izagata

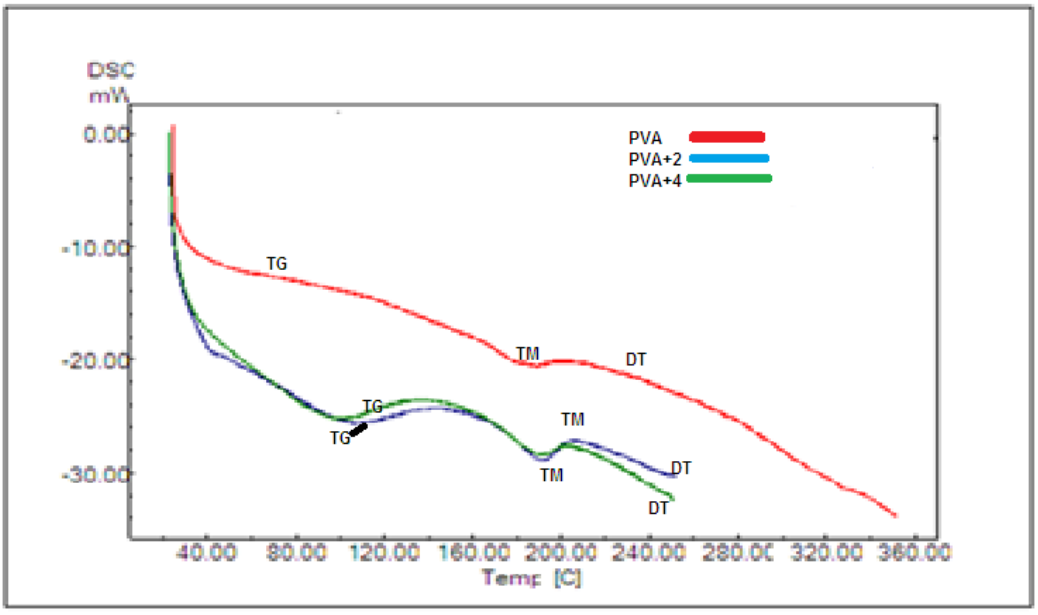

Figure 6: DSC of PVA+ ikon

4.4 FTIR result For (PVA/repellent insect) film

Through this analysis, we observed bonds (PVA and PVA / repellent ikon, izagata) a%ording to the values of bonds recorded in Table (2) by FTIR of pure polymers and the mixture prepared by casting with different concentrations of mixtures.

Table (3) FTIR bond For (PVA/repellent insect) film

Type of Bond	Standard PVA	PVA Exp	PVA +Repellent (Ikon)		PVA +Repellent (Izataga)	
			2 %	4%	2%	4%
O-H Stretching	3331.43	3363.86	3379.29	3479.58	3579.02	3572.17
C=O Stretching	1654.62	1751.36	1681.93	1681.93	1728.22	1720.50
C-H Stretching	2939.95	2885.51	2970.38	-	2970.38	2954.95
-C-H (bending)	1333	1396.46	1288.45	1396.46	1489.05	1442.75
C-C Stretching	849.49	817.82	879.54	871.82	879.54	717.52

FTIR test for PVA shows many bands such as the bands at 3302.13 cm^{-1} for (O-H stretching), the band at 1720.50 cm^{-1} for(C=O stretching), the band at 2885.51 cm^{-1} for (C-H stretching), the band at (1327.o3) cm^{-1} for (-C-H bending), the band at 1118.71 cm^{-1} for (C-O stretching), the band at 817.82 cm^{-1} for for (C-C stretching). The mixture from (PVA/repellent izigata) for 2%, the bands at 3302.137cm-1 shifted to 3549.o3 cm^{-1}, the band at 1720.5 shifted to 1728.22, the band at 2885.51

cm^{-1} shifted to 2947.23, the band at 1327.o3 cm^{-1} shifted to 1334.74 cm^{-1}, the band at 1118.71 shifted to 112643, the band at 817.82 cm^{-1} shifted to 879.54cm^{-1},FTIR of the mixtures from (PVA /repellent ikon , izagata) for different concentrations (2, 4 %), it was observed shifting spectra to lower wave numbers, higher wavenumbers respectively, as show in figure (4.1),(4.2).The results from FTIR.

Note the disappearance of the CH bond at 4%, and this explains the occurrence of an interaction between the polymer and the pesticide, and because the pesticide contains the insistence of OH and the strength of this insistence, the strength of this insistence overcomes the power of CH test reaction between them, this due to bonds appear, while the results show some bonds shifting this due to physical interaction.

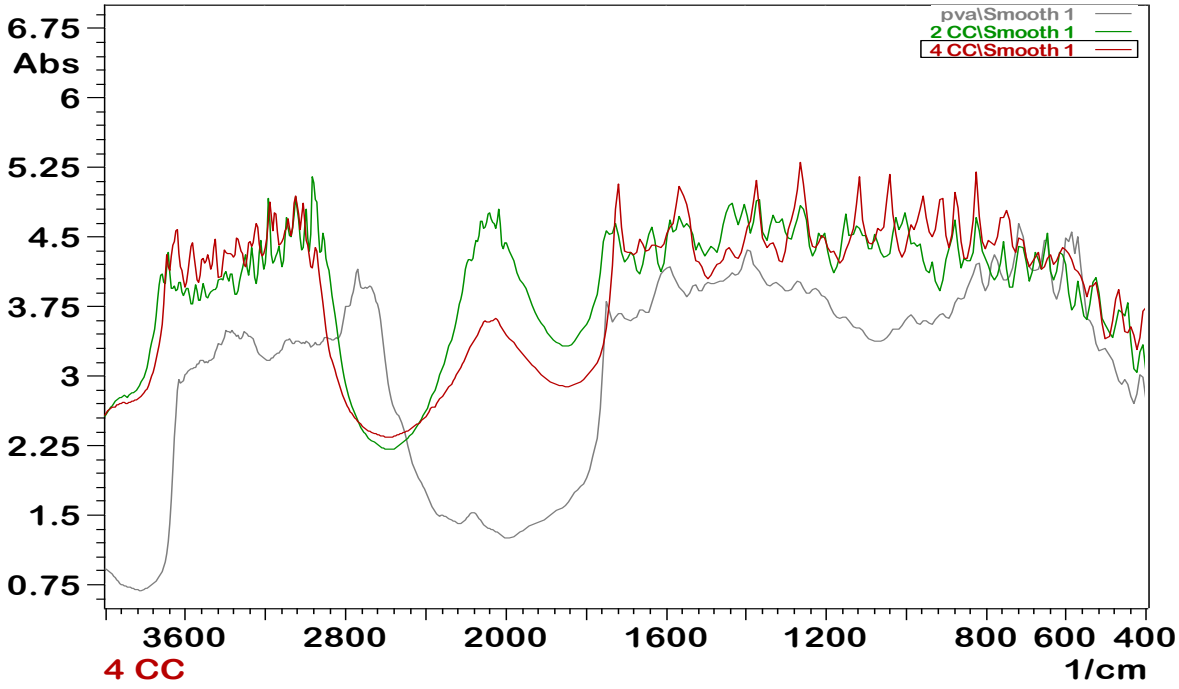

Figure (7): FTIR analysis of PVA+(2,4) repellent izagata

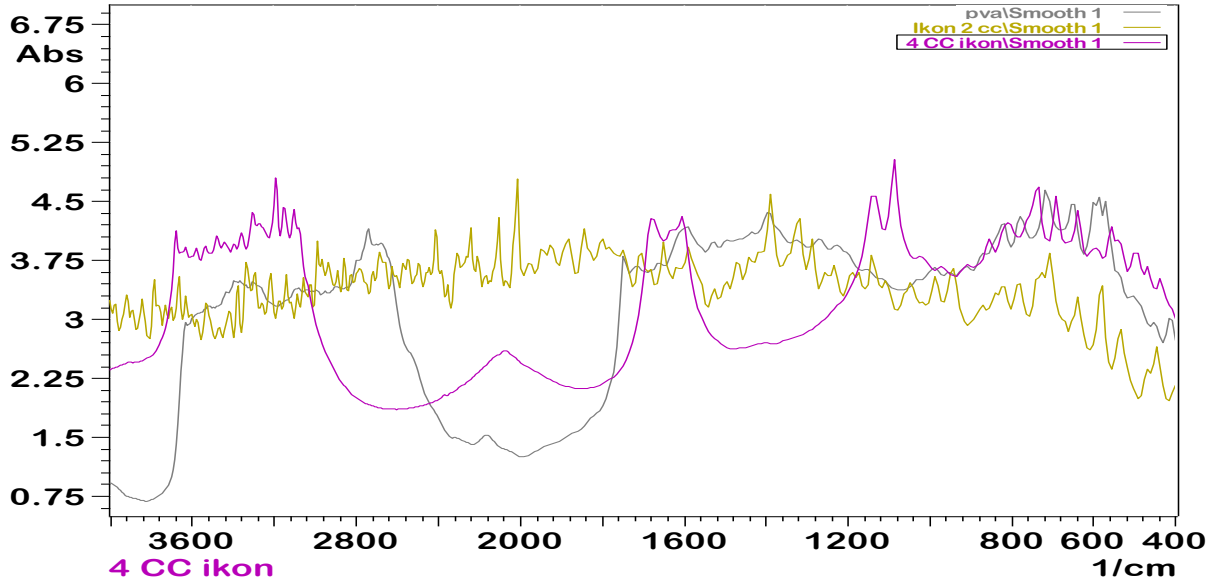

Figure (8): FTIR analysis of PVA+(2,4) repellent izagata

5. Conclusion

1-The insecticide added to the polymer improves the thermal properties and decomposition of TG and TM polymers.

2-The action of the polymer to eliminate the damage caused by pesticides to humans, such as the sensitivity of mucous vessels and discomfort.

3-Adding the polymer to the insecticide did not reduce the effectiveness of the insecticide, but rather increased its effectiveness in killing insects.

4-Through the experience of bioassay, he struck killer insects and eliminated them by 90%.

6.Reference

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