

Grafting of Poly ethylene glycol with Some Monomers

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ABSTRACT

The aim of this research is to grafted of Poly ethylene glycol by using different vinyl monomers which are useful in dentistry because some of the prepared graft co polymers can be shaped and molded and then transformed to a solid, such as Graft Copolymerization of Poly ethylene glycol with Indene (A₁), with dipenten (A₂). With acrylonitrile (A₃), with acrylamide (A₄), with acrylic acid (A₅).

New properties of the substrate of useful derivative as material were extra. Due to their structural diversity and stability, onto backbone of Polymers are formed through chemical reactions that the prepared polymers were characterized by FTIR and H-NMR spectroscopes and thermal analysis were considered.

KEY WORDS: Poly ethylene glycol, Acryl amide, Acrylic acid, Dipentin, Indine.

1. INTRODUCTION

Copolymers are obtained by copolymerization of two or more monomers are sometimes termed bipolymers, those obtained from three monomers gave terpolymers, four monomers gave quarter polymers. (Feng, 2011). Examples: Poly (ethylene-co-propylene) (EP) (Pearce & Eli, 1987). Poly (styrene-co-butadiene) (SBR) Poly (vinylidene chloride-co-vinyl chloride) (Saran), Acrylonitrile / Butadiene / Styrene (ABS) (Volker Abetz, 2005). These structurally simple polymers constitute by far the largest share among plastics and flexibility to required applications depending on the nature of their recurring aside from their molecular weight (Hegazy, 1993). But the freedom of design is greatly widened not only by combining structurally different recurring units into a given polymer thread but also by dominate their ratio and position in the backbone sequence. These give copolymer classes including random copolymers, alternating copolymers with strictly alternating repeating units. Alternating copolymers (Grutke, 1994; Eisenbach, 1995), block copolymers consisting of two or more parts of pure homo successions Block copolymers: (Yamashita, 1990), inlay copolymers in which polymeric side chains of one repeating unit are grafted to a strand of another recurring unit, among others), Different copolymer architectures: random copolymer, alternating copolymer, block copolymer, and grafted copolymer (Koichi, 1985). Amphiphilic and double hydrophilic copolymers enable the formation of micelles an example of Block copolymers for drug delivery. Graft copolymerization is a technique for amending the chemical and physical properties of naturalist and synthetic polymers without drastically affecting its basic qualities (Nishioka, 1984). "Grafting" is a method where in monomers are covalently bonded (altered) onto the polymer chain (Tang, 2007; Dualeh, 1991). Graft copolymers can be gained with three general wayes (Muramatsu, 1990; Eisenbach, 1995; Se, 1997) Fryling, Charles. "High Impact Polystyrene". Patent. Koppers Co Inc. Retrieved 14 February 2014.] . 1. Grafting-onto: A preformed polymer with a reactive end-group is used a precursor, and then joined to the backbone. This method involve reaction of functional groups with another functional (Susheel Kalia & Sabaa, 2013) groups which dispensed randomly on the prime chain of the other polymer (backbone) (Waly, 1998), 2. Grafting-from: The monomer is grafted from the backbone is significantly more inconstant than "grafting-on, 3. Grafting-through in other words grafting via surface-attached monomers (Xie, 2003) are carried out at the presence of polymers (backbone) onto which functionalized monomers have been attached. The hydroxyl groups of cellulose fiber were converted into thiocarbonyl-thio chain transfer agent (Wang, 2011), and were further used to mediate the RAFT polymerization of styrene graft copolymers became widely studied due to their increased number of applications due to their unique structures relative to other copolymers. Some common applications of graft copolymers include: Membranes for the separation of gases or liquids (Muramatsu, 1990). Hydrogels (Eisenbach, 1995), Drug deliverers (Se, 1997). Thermoplastic elastomers (Fryling, 2014; Susheel Kalia, 2013; Waly, 1998; Xie, 2003; Wang, 2011). Polymeric emulsifiers. Impact resistant plastics cellulose microfibers treated with an epoxide and grafted with poly (acrylic acid) (Lee, 2004). Synthesis by Atom Transfer Radical Polymerization. Biomacromolecules (Toledano-Thompson, 2005). Graft polymerization of vinyl monomers onto cotton fibers were reprocessing with amines gave a new properties (Mondal, 2008).

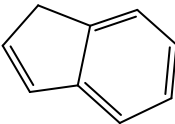
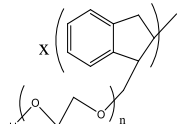
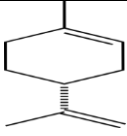
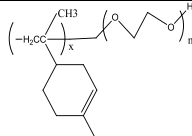
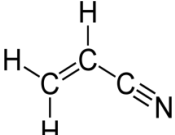
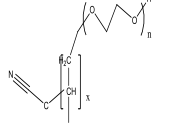
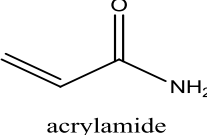
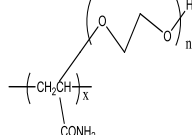
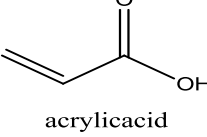
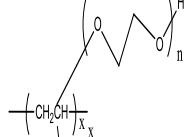
Instruments: FT-IR spectra was recorded using solid KBr discs by testing Shimadzu FT-IR 8000 series Fourier Transform, Infrared Spectrophotometer, Al-Mustansiriyah University, College of Science. Thermal analyses were performed using DSC, TGA and DTG in College Of Education Ibn al-Haytham. ¹H-NMR spectra were recorded on a Fourier transform Varian spectrophotometer, company Bruker, model, ultra-shield 500MHZ, origin: Switzerl and Softening points were determined using Thermal Microscope (Kofler-method), and Reichert thermovar. SP.10/0.25, 160. The degree of swelling for each disk sample after 24hrs was calculated, using the following equation:

$$\Delta m = \frac{m_t - m_0}{m_0} \times 100$$

Where m_0 is the weight of a dry drug polymer at $t=0$, m_t is the swallowed polymer after 24hrs.

Copolymerization of Poly ethylene glycol with some monomers: Indene (A_1), dipenten (A_2), acrylonitrile (A_3), acrylamide (A_4), acrylic acid (A_5): In a screw capped polymerization bottle (10gm) P.E.G dissolved in (5ml) acetone and {(1gm) Indene, or (1gm) dipenten, or (1gm) acrylonitrile (1gm) acrylamide or (1gm) acrylic acid} dissolved in (3 ml) of water, and (0.05gm) dibenzoyl peroxide were introduced in the polymerization bottle. It was flashed with nitrogen for few minutes inside a leaper and resolutely stopped. The medley was heated at 70°C , using water bath for 2 hr. The solvent was vaporized under vacuum; the product was acquired, washed three times with ether. Dried in a vacuum oven at 50°C , created polymers were studied.

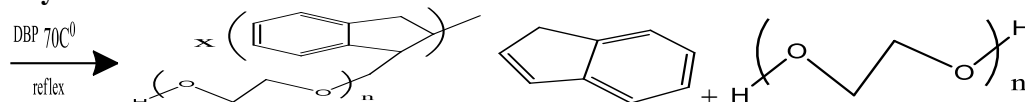
Table.1. Physical properties of prepared polymers

No.	Monomer	Product	Product%	μ_{in} dL/g	Color	S.P
1			89	0.81	yellow	150-157
2			78	0.87	Dark brown	160-169
3			67	0.89	White	165-170
4	 acrylamide		88	0.77	White	140-160
5	 acrylicacid		87	0.97	White	190-200

3. RESULTS AND DISCUSSION

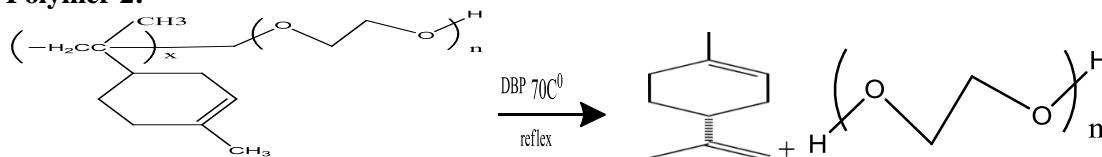
Polyethylene glycol is a linear naturalist polyether. Its chemical structure representation is $\text{HO}-(\text{CH}_2\text{CH}_2\text{O})_n-\text{CH}_2\text{CH}_2\text{OH}$. Polyethylene glycol is non-toxic, odourless, neutral, lubricating, non-volatile and non-irritating and is used in a diversity of pharmaceuticals and in medications as a solvent. Five new graft co-polymers were prepared by the reaction of PEG with different monomers by using dibenzoyl peroxide as a radical initiator as shown below:

Polymer 1:

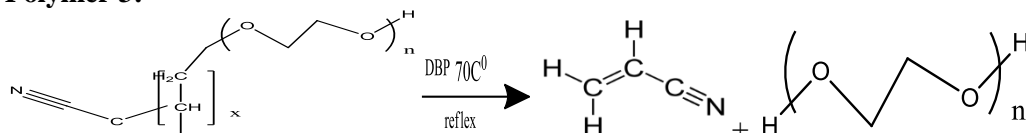


PEG Indene

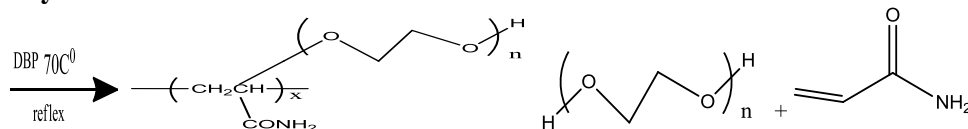
Polymer 2:



PEG dipenten

Polymer 3:

PEG acrylonitrile

Polymer 4:

PEG acrylamide

Polymer be quickly (During the approximately 3 minutes) and it gave a white paste in Simple heat Stiffened,

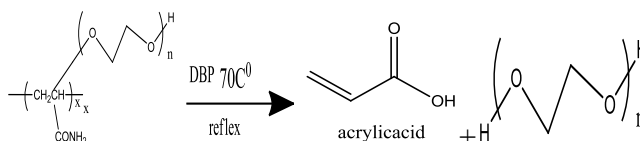
Polymer5:

Fig.1, FTIR spectrum of polymer A₁ showed absorption peaks at 3466.20cm⁻¹ (OH) glycol, 2870.17cm⁻¹ (C-H) aliphatic in Poly ethylene glycol, 1107.18cm⁻¹ (C-O) of Poly ethylene glycol, 1458.23cm⁻¹ (C=C) aromatic ring of indene, 2881 cm⁻¹ (=C-H) aromatic ring of indene.

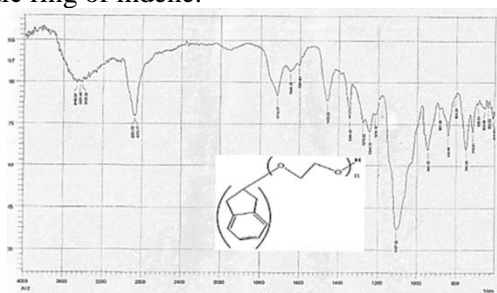
**Figure.1. FTIR spectrum of polymer A₁**

Fig.2, FTIR spectrum of polymer A₂ showed absorption peaks at 2914 cm⁻¹ (ring-CH₃), 1452 cm⁻¹ (C=C) ring of dipenten, 1345 (C-CH₃) of dipenten, 2872cm⁻¹ (CH) aliphatic in Poly ethylene glycol, 1095.60cm⁻¹ (C-O) of Poly ethylene glycol.

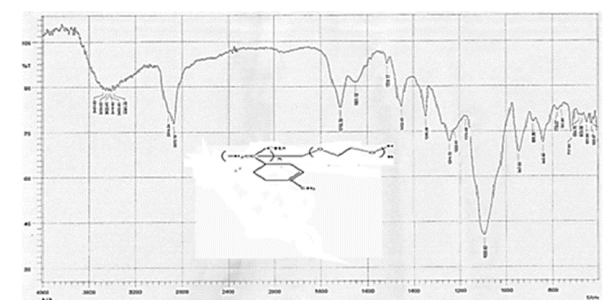
**Figure.2. FTIR spectrum of polymer A₂**

Fig.3, FTIR spectrum of polymer A₃ showed absorption peaks at 1107.18 cm⁻¹ (C-O) Poly ethylene glycol, 2879.82cm⁻¹ (C-H) aliphatic in Poly ethylene glycol, 2250cm⁻¹ (C≡N) nitrile.

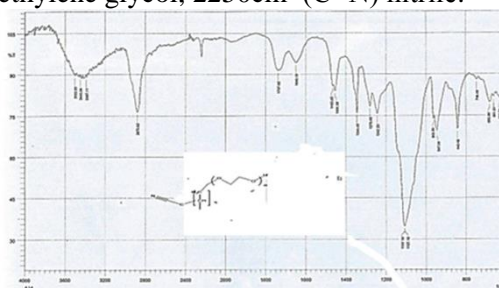
**Figure.3. FTIR spectrum of polymer A₃**

Fig.4, FTIR spectrum of polymer A₄ showed absorption peaks at 1105.25cm⁻¹ (C-O) Poly ethylene glycol, 2875.96cm⁻¹ (C-H) aliphatic in Poly ethylene glycol, 1653.05cm⁻¹ (C=O) amide, 3367.82cm⁻¹(N-H) stretch amide, 1251cm⁻¹ (C-N) amide, 1612.54cm⁻¹ (N-H) bending amide, 684cm⁻¹ (C-H) amide.

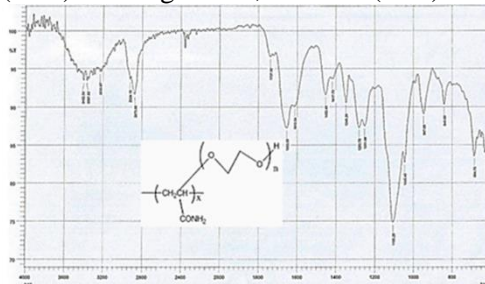


Figure.4. FTIR spectrum of polymer A₄

Fig.5, FTIR spectrum of polymer A₅ showed absorption peaks at 1145cm⁻¹ (C-O) Poly ethylene glycol, 2881.75cm⁻¹ (C-H) aliphatic in Poly ethylene glycol, 1185 cm⁻¹ (C-O) of Acrylic acid 1730.21 cm⁻¹ (C=O) of Acrylic acid, 3462 cm⁻¹ (OH) carboxylic acid.

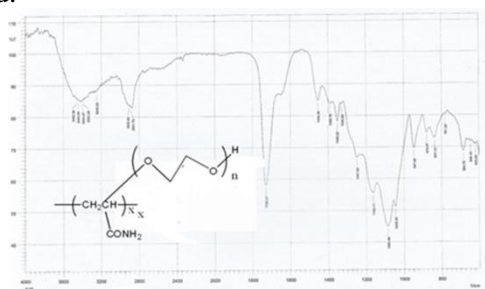


Figure.5. FTIR spectrum of polymer A₅

Fig.6, the ¹H-NMR spectrum of polymer A₃ showed the signals at δ: 2.9 ppm (CH-CO, 1H, T.), δ: 1.17 ppm (CH₂-CH, 2H, d.) polymer, δ: 3.05 ppm (CH-CO, 1H, T.), δ: 2.7 ppm (CH₂-CH, 2H, d.), δ: 3.5 ppm due to (CH₂-CN, 1H, S.), δ 8.5 ppm (COOH, 1H, S.). Fig. (7) the ¹H-NMR spectrum of polymer A₅ showed the signals 2.7 ppm of 2CH₂-CO (2H) d., 2.9 ppm of CH-COOH (1H) and 2.8 ppm of CH-COOH (1H)S. polymer, 1.3 ppm of CH₃ terminal (3H)d., δ.

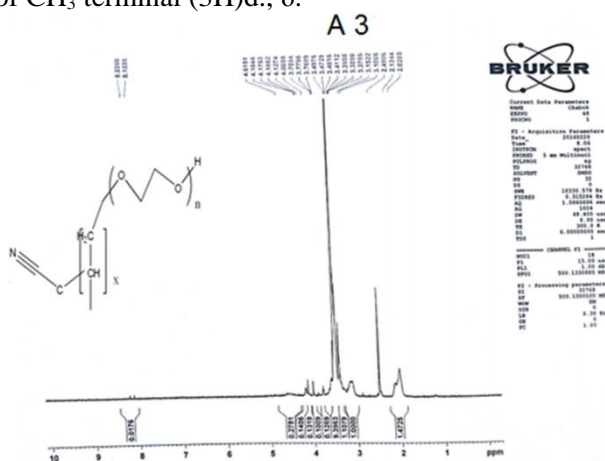


Figure.6. The ¹H-NMR spectrum of polymer A₃

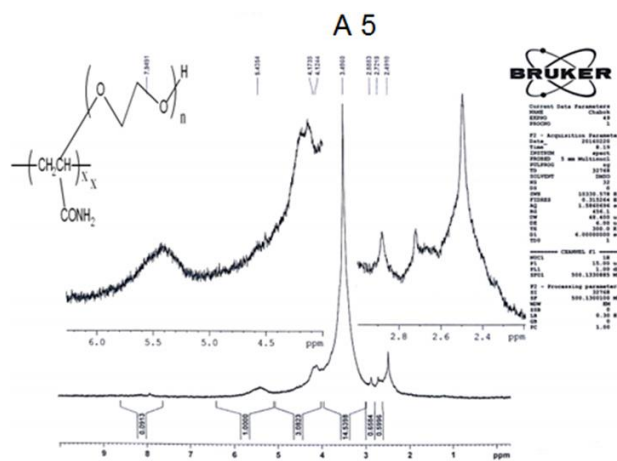


Figure.7. The ¹H-NMR spectrum of polymer A₅

4. CONCLUSION

Polymer [A₄] be quickly shaped (during the approximately 3 minutes) and it gave a white solid material. Did not dissolved in Water, acid, base But turn to Paste in Simple heat stiffened, it don't swelled in Water. The thermal resistance indicated the high interaction between hydrogen bonding of polar groups through the co polymer chains.

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