Faculty of Science

Department: Chemistry

Name: ElRefaie Kenawy

Title: Biollogically active polymers IV: Synthesis and antimicrobial activity of tartaric acid polyamides

Authors: El Refaie Kenawy, Fouad I. Abdel Hay; Lamies Shahada, Abdel Raheem R. El Shanshour & Mohamed H. El Newehy

Published In: Journal of applied polymer science, 102 (2006)

Impact Factor: 1.072

Abstract:

New bactericidal polyamides with quaternary ammonium or phosphonium salts were prepared, and their antimicrobial activities were explored. The polyamides were synthesized by the polycondensation of diethyl-1-tartrate or chloromethylated diethyl-1-tartrate with ethylenediamine in dry absolute ethanol. Thepolyamides were modified to yield polymers with either quaternary ammonium or phosphonium salts. The polymers were characterized with elemental microanalysis and 1H-NMR and IR spectra. The antimicrobial activity of the polymers bearing onium salts was studied against Gram-negative bacteria (Escherichia coli, Pseudomones aeruginosa, Shigella sp., and Salmonella typhae), Gram-positive bacteria (Bacillus subtilis and Bacillus cereus), and a fungus (Trichophytum rubrum) by the cut-plug and viable-cell-count methods. Although all the polymers showed high antibacterial activity, some had no antifungal activity. The tributyl phosphonium salt of the polyamide was more effective against both Hram-negative and Gram-positive bacteria than the triethyl ammonium and triphenyl phosphonium salts of the polyamide.

Key words:

Biological applications of polymers; polyamides; polycondensation; antimicrobial

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Abstract:

New bactericidal polyamides with quaternary ammonium or phosphonium salts were prepared, and their antimicrobial activities were explored. The polyamides were synthesized by the polycondensation of diethyl-1-tartrate or chlormethylated diethyl-1-tartrate with ethylenediamine in dry absolute ethanol. The polyamides were modified to yield polymers with either quatemary ammonium or phosphonium salts. The polymers were characterized with elemental microanalysis and ^{1}H-NMR and IR spectra. The antimicrobial activity of the polymers bearing oniom salts was studied against Gram-negative bacteria (Escherichia coli, Pseudomones aeruginosa, Shigella sp., and Salmonella typhae), Gram positive bacteria (Bacillus subtilis and Bacillus cereus), and a fungus (Trichophytum rubrum) by the cut-plug and viable-cell-count methods. Although all the polymers showed high antibacterial activity, some had no antifungal activity. The tributyl phosphonium salt of the polyamide was more effective against both Gram-negative and Gram-positive bacteria than the triethl ammonium and triphenyl phosphonium salts of the polyamide.

Key works:

Biological applications of polymers; polyamides; polycondensation; antimicrobial

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Department: Chemistry

Name: El Refaie Kenawy

Title: The chemistry and applications of antimicrobial polymers: a state-of-the-art review

Authors: El Refaie Kenawy, S.D. Worley, and Roy Broughton

Published In: Americam Chemical Society,8 (2007)

Impact Factor: 3.618

Abstract:

Microbial infection remains one of the most serious complications in several areas, particularly in medical devices. Drugs, health, care and hygienic applications, water purification systems, hospital and dental surgery equipment, textiles, food packaging, and food storage, Antimicrobials gain interest from both academic research and industry due to their potential to provide quality and safety benefits to many materials. However, low molecular weight antimicrobial agents suffer from many disadvantages, such as toxicity to the environment and short-term antimicrobial ability. To overcome problems associated with the low molecular weight antimicrobial agents. Antimicrobial functional groups can be introduced into polymer molecules. The use of antimicrobial polymers offers promise for enhancing the efficacy of some existing antimicrobial agents and minimizing the environmental problems accompanying conventional antimicrobial agents by reducing the residual toxicity of the agents, increasing their efficiency and selectivity, and prolonging the lifetime of the antimicrobial agents. Research concerning the development of antimicrobial polymers represents a great a challenge for both the academic world and industry. This article reviews the state of the art of antimicrobial polymers primarily since the last comprehensive review by one of the authors in 1996. In particular, it discusses the requirements of antimicrobial polymers, factors affecting the antimicrobial activities, methods of synthesizing antimicrobial polymers, major field of applications, and future and perspectives in the field of antimicrobial polymers.

Faculty of Science

Department: Chemistry

Name: El-Refaie Kenawy

Title: A new degradable hydroxamate linkage for pH-controlled drug delivery

Authors: El-Refaie Kenawy; Mohamed El-Newehy; Fouad Abdel-Hay & Raphael M. Ottenbrite

Published In: Bio-macromolecules, 8 (2007)

Impact Factor: 3.618

Abstract:

A new drug delivery system based on a hydrogegradable hydroxamate linkage was evaluated. The carrier support system was poly(N-hydroxyacrylamide), which was synthesized via free radical polymerization of acryloyl chloride in 1,4-dioxane, initiated with 2,2'- azobisisobutyronitrile. The poly (acryloyl chloride) was modified in two steps. First, N-hydroxysuccinimide was added to give the imide ester of poly(acryloyl). In the second step, the imide ester of poly(acryloyl) was reacted with either hydroxylamine or N-methylhydroxylamine to give the corresponding hydroxamic acid. The hdroxamide functionalit was then used to link the model drug ketoprofen. All products and intermediates were characterized by elemental analysis and FTIR and 1H NMR spectra. In vitro drug release was performed under specific conditions to elucidate the influence of the pH, polymer microstructure, and temperature on the hydrolysis rate of the amido-ester bond that linked the drug to the macromolecule. The drug release rate from N-methylhydroxamic acid polymers was faster than from hyroxamic acid polymers. All polymers showed higher rates of drugs release at higher pH values (9.0 > 7.4 > 2.0) and at higher temperatures (37 C >20 C).

Faculty of Science

Department: Chemistry

Name: E-l-Refaie Kenawy

Title: Effect of pH on the drug release rate from a new polymer-drug conjugate system

Authors: El-Refaie Kenawy, Fouad Abdel-Hay , Mohamed El Newehy & Raphael M. Ottenbrite

Published In: Society o chemical industry , 57(2007)

Impact Factor: 1. 251

Abstract:

The corresponding N-hydroximide and N-methl=N-hydroximide of poly [ethylene-alt-(maleic anhydride)] (weight average molecular weight (M_w) of 100-500 g mol $^{-1}$) were prepared as a new oral drug delivery system . Syntheses of N-hydroximide and N-methylhydroxamic acid of poly [ethylene-alt (maleic anyydride) were carried out by chemical modification of polymer with hydroxylamnine and N-methylhydroxylamine, respectively, to give water –soluble polymers. These activated polymers were immobilized with ketoprofen in the presence of dicyclohexylcarbodiimide to give the corresponding water-insoluble ketoprofen conjugates. All products were characterized by elemental nalysis as weel as Fourier transform infrared and ^{1}H NMR spectra. In vitro release of ketoprofen was studied by measuring UV absorption at ג $_{max}$ = 260 nm as a function of time. This study demonstrate dthe potential use of N-hydroximide and N-methyl-N-hydroxamic acid of poly [ethylene-alt(maleic anhydride)] as drug delivery system. Controlled release was studied at different pH values and at different temperatures. At physiological temperature, the amount of drug released increased with increasing pH . The copolymer-drug adducts released the drug very slowly the low pH found in the stomach thus protecting the drug from the action of high acid conditions and resident digestive enzymes. These N-hydroxamic acid polymer-drug conjugates were found to be pteontially useful in the delivery of macromolecular drugs to targeted sites in the lower gastrointestinal tract and the colon area.

Key words:

Drug delivery, controlled release; hydroxamic acid polymer ; N-methylhydroxamic acid polymer; poly[ethylene-alt(maleic anhydride)]; 1,3-dicyclohexylcarbodiimide (DCC).

Faculty of Science

Department: Chemistry

Name: El-Refaie Kenay

Title: Controlled release of ketoprofen from electrospun poly(vinyl alcohol) nanaofibers

Authors: El-Refaie Kenawy, Fouad I. Abdel-Hay, Mohamed H. El-Newehy & Gary El Wnek

Published In: Materials science and engineering, 459 (2007)

Impact Factor: 1.347

Abstract:

Poly(vinyl alcohol) (PVA) as a biodegradable hydrophilic polymer has unique properties. It absorbs water and swells easily, but the swelling is inhibited by salts. Its physico-chemical properties depend on the degree of hydrolysis. The solubility of PVA in water increases greatly as its degree of hydrolysis increases. In the current work, new systems for the delivery of ketoprofen as non-steroidal anti-inflammatory drug (NSAID) were developed. New electrospun fibers containing ketoprofen and made from partially and fully hydrolyzed poly (vinyl alcohol) (PVA) were developed as drug delivery system. Moreover, electrospun PVA fibers were stabilized against disintegration in water by treatment with alcohol such as methanol. The release of ketoprofen from the electrospun fibers was determined by UV spectrophotometer at the body temperature (37 °C) and at the room temperature (20 C) . The result showed that upon the treatment of electrospun PVA with alcohol, the burst release was eliminated.

Key words:

Electropinnin, poly(vinyl alcohol); controlled-release; Ketoprofen; Anti-inflammatory drug.