جامعة عين شمس
كلية العلوم
قسم الكيمياء

التحضير والتطوير بالإشعاع لمواد بوليمرية تطبق فى عمليات تعبئة الغذاء ونشاطها وتحللها الحيوى

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Radiation Synthesis And Modification Of Polymeric Material Applied In Food Packaging And Their Bioactivity And Biodegradation

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List of abbreviations

Abbreviation	Name
$(NH_4)_2SO_4$	Ammonium sulfate
σ	Bending
CO_2	Carbon dioxide
cm	Centimeter
°C	Degrees celsius
DSC	Differential scanning calorimetry
K_2HPO_4	Di-potassium hydrogen phosphate
$K_2HPO_4.3H_2O$	Di-potassium hydrogen phosphate tri-hydrate
$FeSO_4.7H_2O$	Ferrous sulfate heptahydrate
FTIR	Fourier transfer infrared spectra
γ	Gamma rays
g%	Gel fraction
G	Glycerol
gm	Gram meter
gm/l	Gram per liter
h	Hour
HCl	Hydrogen chloride
OH	Hydroxyl group
I_2	Iodine

kGy	Kilo grey
kJ/mol	Kilo joule per mol
LA	Lactic acid
$MgSO_4$. $7H_2O$	Magnesium sulfate heptahydrate
MPa	Mega pascal
µl	Microliter
ml	Milliliter
mm	Millimeter
MSM	Minimal salt medium
(NCRRT)	National Center For Radiation Research and Technology
NR	Natural rubber
N_2	Nitrogen
N	Normal
O_2	Oxygen
%	Percent
PLST	Plasticizer
PLA	Poly lactic acid
PVA	Poly vinyl alcohol
KBr	Potassium bromide
KI	Potassium iodide
KH_2PO_4	Potassium phosphate monobasic
rpm	Revolutions per minute
SEM	Scanning electron microscope

List of abbreviation

NaCl	Sodium chloride
υ	Stretching
S%	Swelling percent
TS	Tensile strength
TGA	Thermogravimetric analysis
v/v	Volume/Volume
w/v	Weight/Volume
w/w	Weight/Weight

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Characterization of Radiation Prepared Copolymer and Studies of Their Biodegradability

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Abstract

Blends of biodegradable copolymer based on starch, poly lactic acid (PLA), poly vinyl alcohol (PVA) and natural rubber (NR) have been prepared. Gamma radiation induced synthesis and modification of polymer hydrogel was studied. The polymer blends have been chemically surface modified by glycerol. The modified polymer blends have been investigated for swelling ratio, tensile strength and 9 scanning electron microscopy. The swelling ratio of polymer blends increased significantly after surface modification with glycerol. The swelling of polymer was decreased as a function of (NR) content in polymer blends. The gel fraction (PVA-starch-PLA) and (PVA-starch-NR) blends increased by increasing the radiation doses (kGy) to reach the maximum amount of (~99%) and (~88.2%), respectively. Addition of 2.5% (PLA) led to greater increase of the swelling ratio than 10% (NR) to blends and the maximum swelling was found at dose (5 kGy). At concentration of glycerol (5.0% w/w), tensile strength decreased and elongation at break % increased. The polymers degrading microorganisms were isolated from soil samples. The degradation ability of the microbial isolates for each polymeric material was tested on agar plates. Among these isolates, the most efficient degrader isolates for prepared blends in MSM shaking flasks were selected and the degradation was confirmed by scanning electron microscopy.

Keywords

Radiation, Biodegradation, (NR), (PLA), Renewable Resources, Mechanical Properties, Scanning Electron Microscopy