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The Using of The Soap of The Beta Vulgaris to Modify Polyurethane Foam as an Antimicrobial Polymer

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Abstract:

Polymeric materials containing the soap of The Beta vulgaris have not been studied and applied to a variety of antimicrobial-relevant areas.

The soap of The Beta vulgaris was prepared using the ordinary cocking method. The soap was mix with polyurethane foams in to ways but one of the two ways produce a weak polymer matrix.

In order to know the activity of the soap of The Beta vulgaris as an antimicrobial agent mixed with polyurethane foam. The types of microbes were used.

Susceptibility was determined by the Kirby Bauer disk diffusion method Bacteria (*Staphylococcus auras*, *Escherichia coli*) and Fungi (*Candida albicans*) were grown on nutrient broth at 37C overnight

The obtained results show no clear inhibition zone for the three microbes. The amazing result is that the soap of The Beta vulgaris is working as a biodegradation agent that when mix with the foam of polyurethane will produce a biodegradable polymer foam.

Keywords: antimicrobial; polymer; Beta vulgaris; polyurethane

Introduction:

Since bacteria exist everywhere and can be spread through air, water and food, *etc*. the control and prevention of microbial infections becomes a daunting challenge. To combat with microbial pathogens, all kinds of antimicrobial agents, including antibiotics, disinfectants and antiseptics, have been developed substantially. However, the widespread and injudicious use of antibiotics and disinfectants has induced the emergence of new strains of antimicrobial-resistant microorganisms, leading to dramatically increased difficulties in the antimicrobial issue [1–5].

With all these challenges a new promising technology appears called antimicrobial polymers exhaustive studies on synthesis and application of such "intrinsically"

Antimicrobial polymers have been started in the 1970s [6-8]. Antimicrobial polymers represent a very promising class of therapeutics with unique characteristics for fighting microbial infections antimicrobial activity can be also used for the direct elimination of microorganisms as antibiotics.

On these matters, the design and synthesis of antimicrobial polymers have gained increasing attention by the scientific community as a safe and effective strategy to combat multidrug-resistant microbes [9-11].

Antimicrobial polymers are defined as polymers having biocidal pendant groups or biocidal repeat units in the polymer chemical structure. The simple addition of a biocide to a polymer matrix should not be deemed as a method for producing antimicrobial polymers[12] .

The use of polymers as antimicrobial agents presents several advantages, since these products usually exhibit long-term activity and limited residual toxicity, are chemically stable, non-volatile and do not permeate through the skin [12-13] . According to the type of polymeric system, antimicrobial polymers can be classified into three categories: (i) biocidal polymers, which are polymers with intrinsic antimicrobial activity; (ii) polymeric biocides, which are based on polymer backbones with biocide molecules attached; and (iii) biocide-releasing polymers, which consist of Polymers loaded with biocide [14-17].

Researchers are trying to introduce new antimicrobials agents which are effective against drug resistant bacteria, economically cheaper and which can be easily incorporated into polymers having wide range of applications [18-19].

In this paper it has been focused on polyurethane foam since Polyurethanes have many characteristics and can be used in a lot of products especially in medical industries. In combination with an anti-microbial agent the polyurethane application range can be wider.

The aim of this study was to develop antimicrobial polymer by impregnation with Beta vulgaris.

Antimicrobial Sensitivity Testing

Susceptibility was determined by the Kirby Bauer disk diffusion method Bacteria (*Staphylococcus auras ,Escherichia coli*) and Fungi (*Candida albicans*) there were grown on nutrient broth at 37C overnight. The suspension was visually adjusted with normal saline to equal that of 0.5 McFarland turbidity standards. The inoculum was Swabbed across the entire surface of Muller Hinton agar plate .using sterile swab stick and the plate was rotated to ensure

an even distribution The inoculated plates were left to stand for at least 3 minutes, but for no longer than 15minutes before the disks were applied. Synthesis disks used include: The plates were incubated within 15 minutes of the application of the disks at 37C for 18 to 24 hrs. The inhibition zone diameters around the disks were measured. It is necessary here to mention that the radius of plates is 0.6 cm which is standard for such kind of antimicrobial polymers. All microbes were distinguished by Vitk 2 system.

Figure (1) shows the modified polyurethane with The Beta vulgaris after 2 minutes of the reaction

Figure (1) the modified polyurethane foam with The Beta vulgaris

Results and discussion:

Pure polyurethane is prepared by the reaction of a liquid isocyanate with a liquid blend of polyols. The Beta vulgaris was added to the polyurethane foam by two ways. The first way was by adding the Beta vulgaris soap immediately with the foam component .The obtained foam was in loss of good mechanical properties like toughness, compressive and etc. where the measure of these properties needs no device since these properties clearly and macroscopically weak . So I came to use another preparation method since the first way was not suitable since the prepared sample divided in to many pieces due to cutting process. The second way to use the Beta vulgaris soap after he foam preparation complete to final form where the Beta vulgaris added to the polyurethane foam and then an absorption process to the soap is occur. The second way was suitable since the foam has good macroscopically mechanical properties and can be cut to the obtained shape. It is important here to mention that the Beta vulgaris soap wad made by polling the plant in to a liter of water for 45 minutes.

The figures 2 , 3 and 4 show the modified polyurethane disks where the figures (2) and (3) show the

growth, antibacterial effect and Susceptibility of gram positive and negative bacteria (*Staphylococcus auras ,Escherichia coli*) respectively . Figure (4) shows the mentioned effects but on Fungi (*Candida albicans*).

From the first sight to these figures it can be seen the absence of a clear inhibition zones though there is a weak inhibition zone with E coli.A. The second obtained result is that the soap of The Beta vulgaris is distributed around the polyurethane disk indicating some kind of soap releasing were this release with a random distribution . It is necessary to mention that the disk after 3 days and more have a heavy increasing of growing of Bacteria (*Staphylococcus auras ,Escherichia coli*) and Fungi (*Candida albicans*)which is a good results not in the using of modified polyurethane foam as antibacterial polymer but in using the soap of The Beta vulgaris as an agent that leads to biodegradation of polyurethane . The last result is too important due to the cheap and easy way to deal with the mass mount of garbage polyurethane through mixing it with the soap the soap of The Beta vulgaris to transfer them from the case of no degradable polymers causing pollution to the case of biodegradation polymers introducing bio gas to use in industry specially in the field of biogas and using this gas in to power generators.

Figure (2) The Susceptibility and growth of bacteria (*Staphylococcus*)

Figure (3) The Susceptibility and growth of bacteria (*E. Coli*)

Figure (4) The Susceptibility and growth of Fungi (*Candida albicans*)

Conclusion:

The way of adding Beta Vulgaris soap is very important in mechanical properties of polyurethane foam. No antimicrobial effect of modified polyurethane foam with Beta Vulgaris. The biodegradation chance is appear for the modified polyurethane foam which may lead to a very cheap way to produce biogas.

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