PHOTOCATALYTIC AND ANTIBACTERIAL BEHAVIOR OF COMPOSITE NANOFILMS, CONTAINING POLYLACTIDE (PLA), POLYVINYLPYRROLIDONE (PVP) AND HYDROZINCITE

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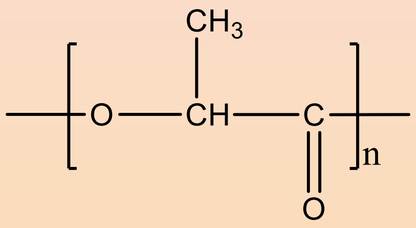
Materials of biodegradable ad non-toxic biocompatible aliphatic polyesters such as polylactide attract increasing interest. Recently using sol gel method, which is an effective tool for preparation of nanocomposite films under mild and non-destructive conditions were prepared new hybrid nanocomposites of poly(L-lactide)/hydrozincite and poly(L-lactide)/hydrozincite/polyvinylpyrrolidone.

AIM

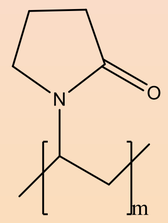
- Preparation of poly (L-lactide)/hydrozincite and poly (L-lactide)/hydrozincite/polyvinylpyrrolidone films.
- Characterization of synthesized nanocomposite films using FT-IR spectroscopy and XRD analysis.
- Investigation of the photocatalytic ability of synthesized materials in the degradation reaction of Malachite green and Reactive Black 5 dyes under UV light and antibacterial activity against the pathogen Escherichia coli.

Materials and Methods



Poly(L-lactide), PLA

biologically tolerable and biodegradable polymer from renewable source



Polyvinylpyrrolidone, PVP

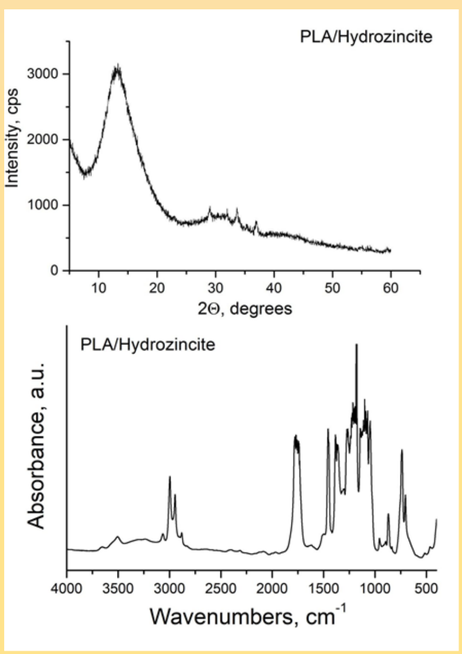
non-toxic biocompatible polymer

$Zn_5(OH)_6CO_3)_2$ hydrozincite

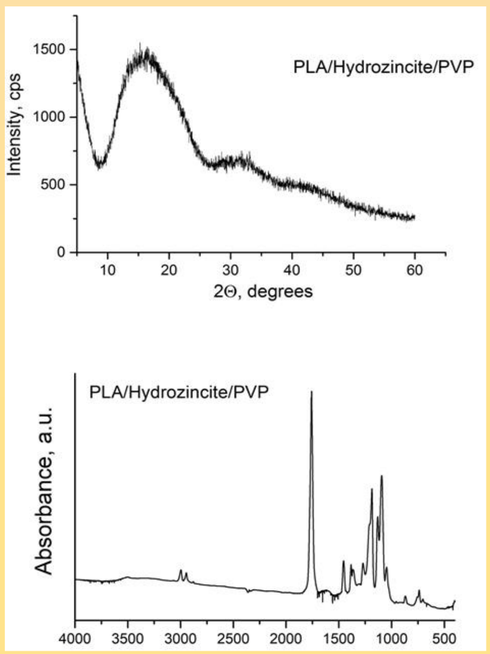
Synthetic mineral compatible with the environment, with antibacterial properties. Used for treatment by photocatalysis of wastewater containing reactive dyes.

The nanocomposite poly (lactide)/hydrozincite film is prepared by the following steps:
A. Preparation of a hydrozincite suspension ($Zn_5(OH)_6CO_3)_2$), 5wt% (synthesized by hydrothermal method at 180° C using Mentha Arvensis) and dichloromethane; B. A solution of poly (lactide)/PLA/ in dichloromethane was added. After mixing the hydrozincite and PLA, the resulting solution was sonicated for 15 minutes until the suspension became homogeneous; C. Thin films of poly (lactide)/hydrozincite with copolymer polyvinylpyrrolidone/PVP/ were prepared as described above, but PVP was dissolved in ethanol added to the nanocomposite suspension.

Characterization

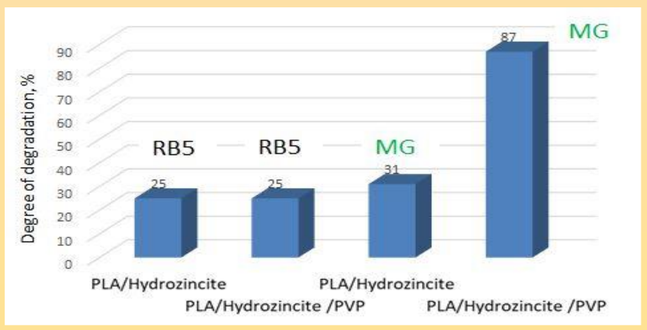


PXRD pattern and FT-IR spectrum of synthesized PLA/Hydrozincite.



PXRD pattern and FT-IR spectrum of synthesized PLA/Hydrozincite/PVP.

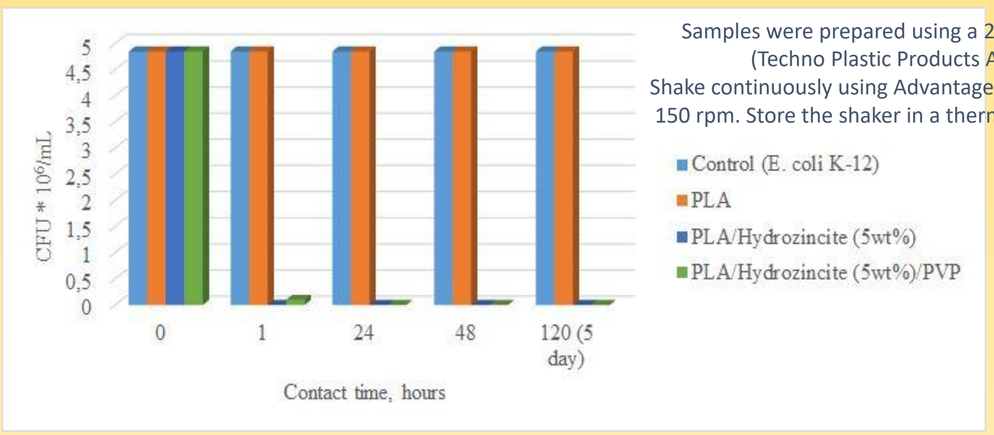
Photocatalytic tests



Degree of degradation of Malachite Green and Reactive Black 5 dyes in aqueous solution after 150 minutes under UV light using prepared PLA/Hydrozincite and PLA/Hydrozincite/PVP nanofilms.

The comparative photocatalytic investigations about degradation of two model dyes – Malachite Green (MG) and Reactive Black 5 (RB5) in aqueous solution (5 ppm) under UV light were performed.
The PLA/Hydrozincite and PLA/Hydrozincite/PVP photocatalysts have higher degradation degree towards MG dye after 150 minutes UV irradiation (31 and 87 % resp.) than those towards RB5 dye (about 25%).

Antimicrobial activity



Samples were prepared using a 24-well test plate (Techno Plastic Products AG, Switzerland). Shake continuously using Advantage-Lab, AL05-06 at 150 rpm. Store the shaker in a thermostatic room at 20 ± 1 ° C.

CONCLUTIONS

- The photocatalytic activity and antibacterial efficacy against Escherichia coli (food pathogen) of the synthesized nanofilms were investigated.
- The films have excellent bactericidal activity against E.Coli. After 1 hour of contact, the bacterial concentration decreased by about 97% and 99% for PLA/Hydrozincite and PLA/Hydrozincite/PVP, respectively.
- The biocomposite films of PLA and PLA/PVP containing 5wt% hydrozincite powders could be used as an alternative of standart food package materials.