



Short Term Scientific Mission (STSM)

**Preparation of active packaging films based on biopolymers and bioactive extracts from plants and fungi by electrospinning technique**

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COST FP<sub>1405</sub>

ACTIVE AND INTELLIGENT FIBRE-BASED PACKAGING – INNOVATION AND MARKET INTRODUCTION

15.06.-30.06.2017



COST is supported by  
the EU Framework Programme  
Horizon 2020

# FROM SERBIA TO SPAIN



# Home Institution

University of Novi Sad  
**INSTITUTE OF FOOD TECHNOLOGY**



Research



Knowledge  
transfer



Services

- Expertise
- Relevant EU projects
- Expectations

AP4INNO, Kick-off meeting Pecs, Hungary 24th-25th October 2012

**Institute of Food Technology is one of the leading research institutes in the field of food and feed science and technology and dissemination of knowledge in Serbia and South Eastern Europe.**

# Host Institution



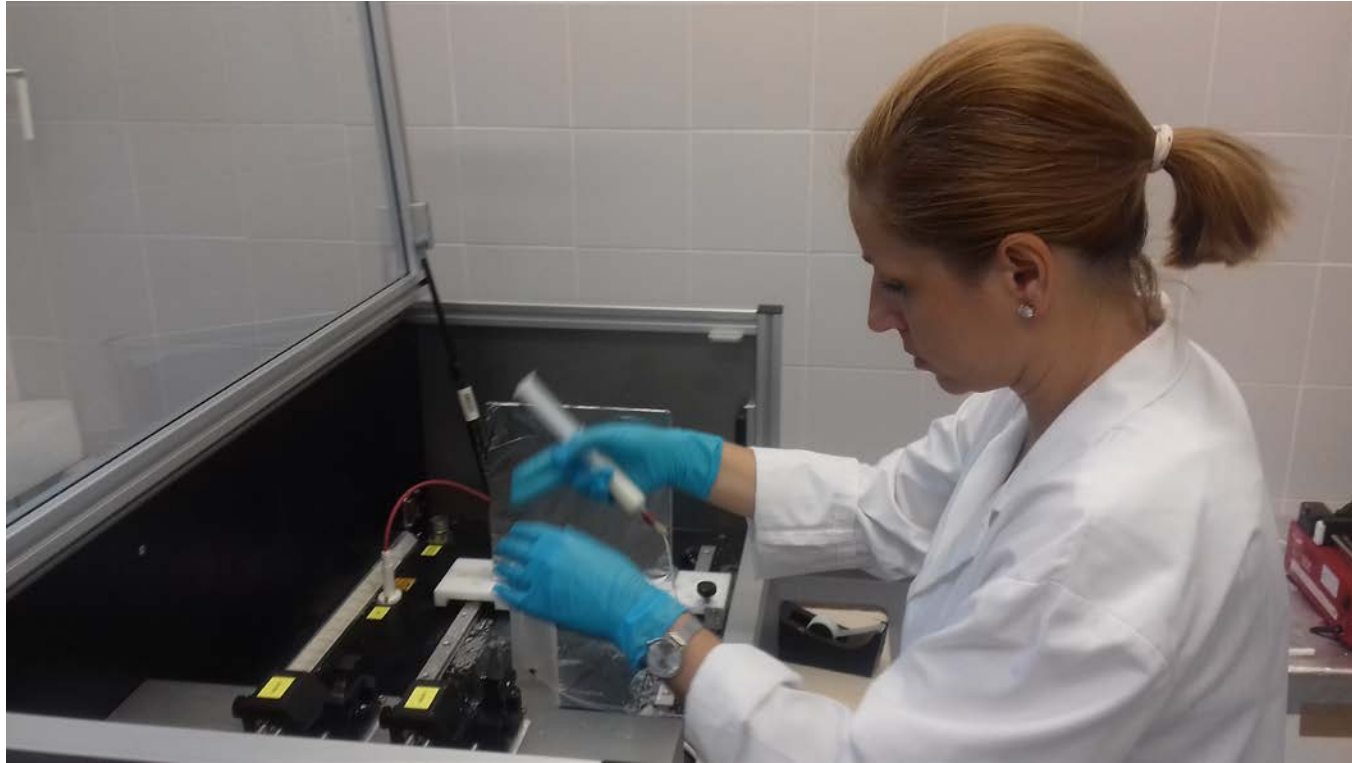
**DR JOSE MARIA LAGARON, NOVEL MATERIALS AND NANOTECHNOLOGY LAB  
IATA CSIC**

The working plan covers following experimental goals:

## Preparation of polymer/extract solutions and electrospinning of prepared systems



# Electrospinning of prepared systems



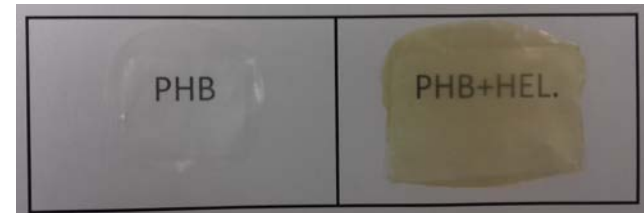
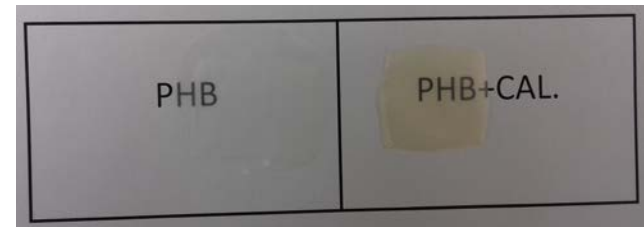
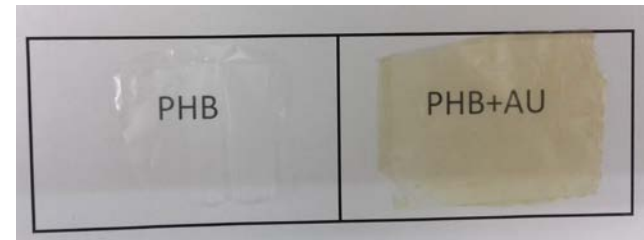
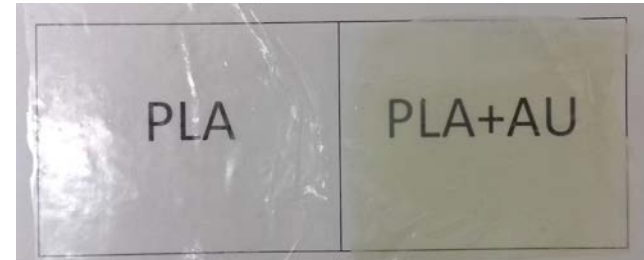
Electrospinning was performed using a Fluidnatek® LE10 lab line from Bioinicia S.L. (Valencia, Spain) with a variable high-voltage 0-30 kV power supply. The biopolymer solutions were electrospun at room temperature, *i.e.* 25°C, for a given processing time and in optimal conditions to achieve steady fiber formation.

# Preparation of films



Electrospun mats were subjected to annealing process using a hydraulic press optimally performed at 145-160°C, without pressure, for  $5 \pm 1$  s

The resultant films were air cooled at room temperature. Prior to annealing treatment, the electrospun films were equilibrated in a desiccator at 0% RH and 25°C for at least 1 week.

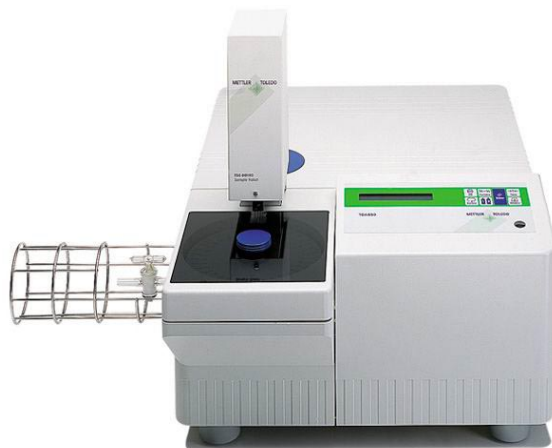


# Characterisation

DSC



TGA



SEM



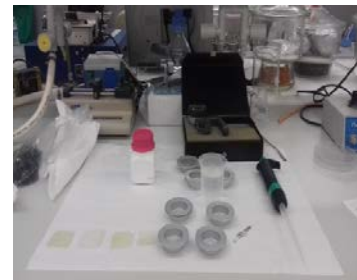
FTIR



WAXD



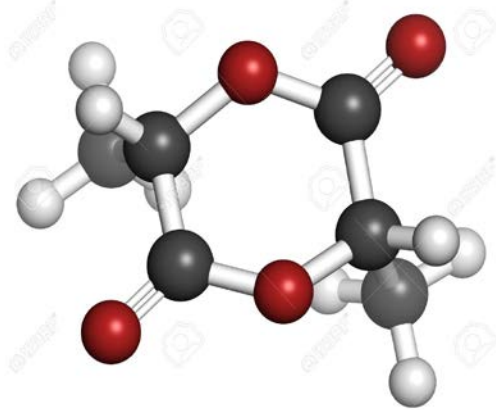
WVTR





# Results and discussion

PLA



According to the amount of material and preparation of the solvent the best results were obtained for PLA with AU extract

*Allium ursinum*



*Calendula*



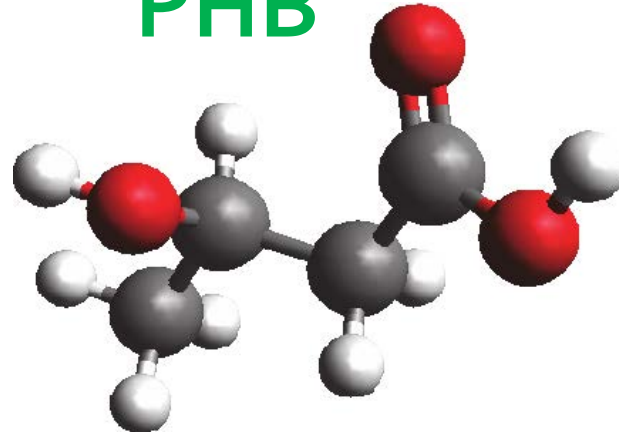
*Helichrysum*



Samples of PLA with *Calendula* and *Helichrysum* were not compatible because of the polarity of the solvents and significant phase separation, so the electrospinning process was not possible.

# Results and discussion

PHB

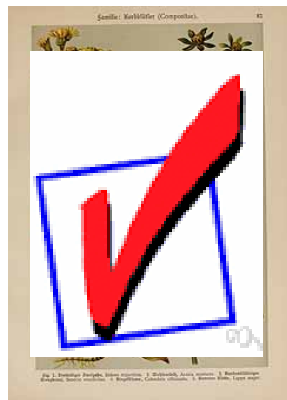


Solutions of PHB loaded with all three extracts were successfully processed on electrospinning machine

*Allium ursinum*



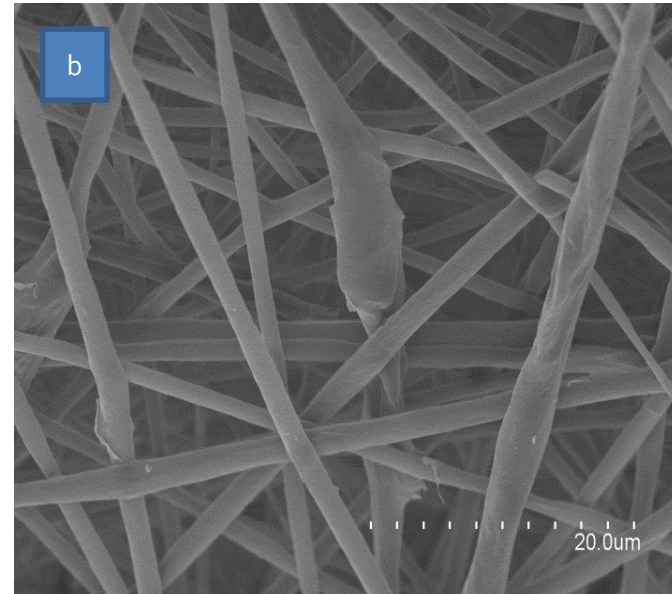
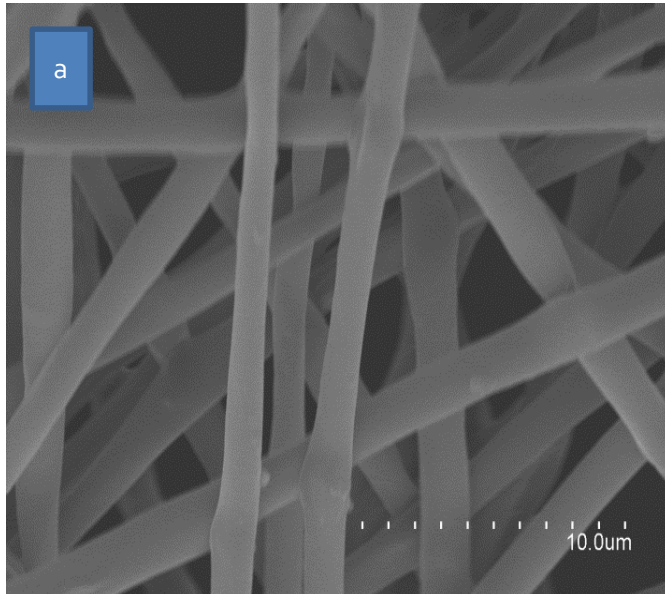
*Calendula*



*Helichrysum*

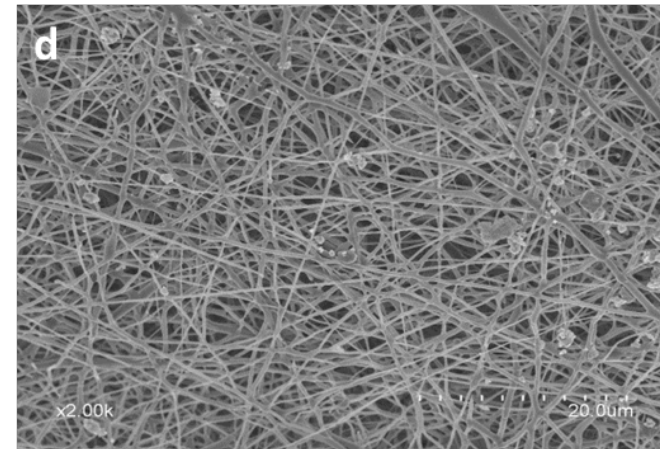
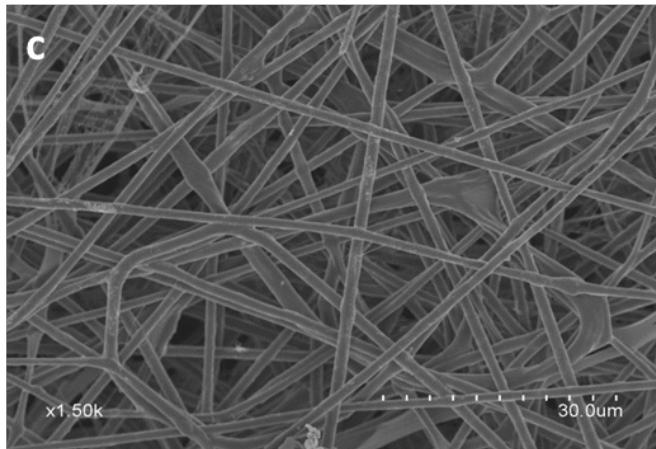
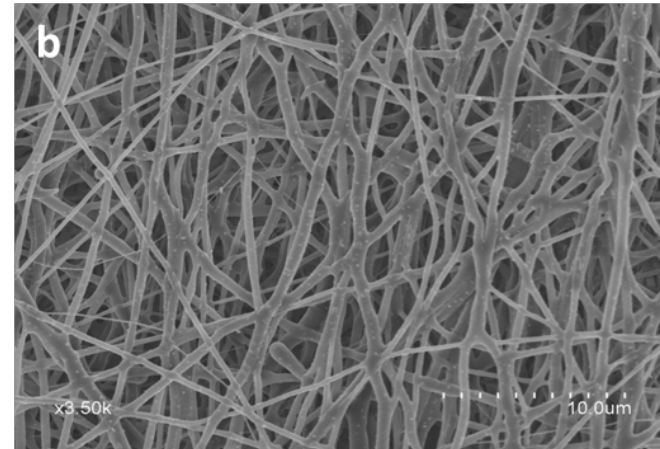
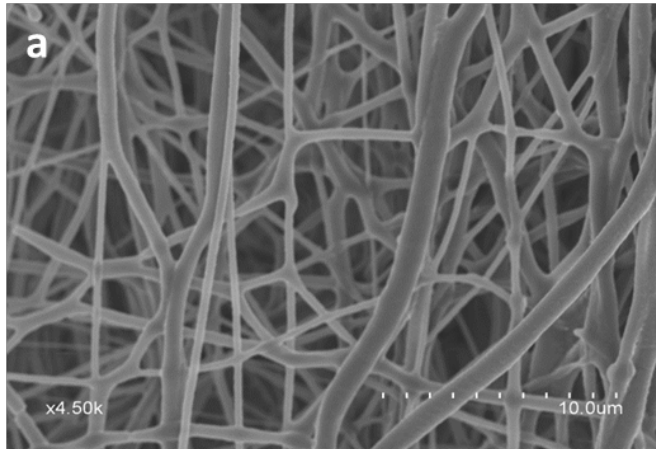


# Morphology of the PLA fiber



**Morphology of the mats of PLA (a) and PLA with 10 wt.% (b) of AU extract**

# Morphology of the PHB fiber

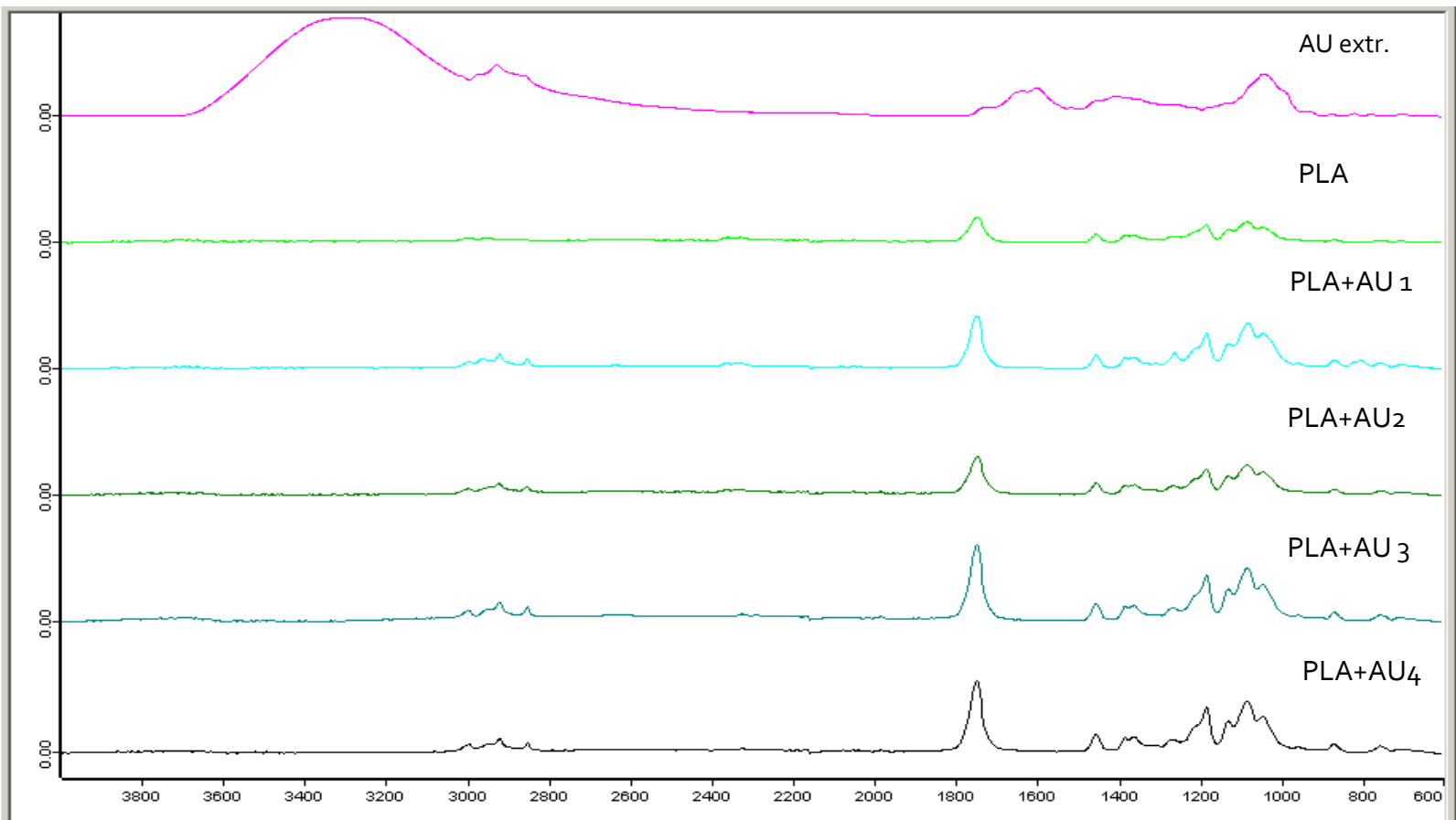


Morphology of the PHB mats (a) PHB+HEL(b) PHB+CAL(c) and PHB+AU (d)



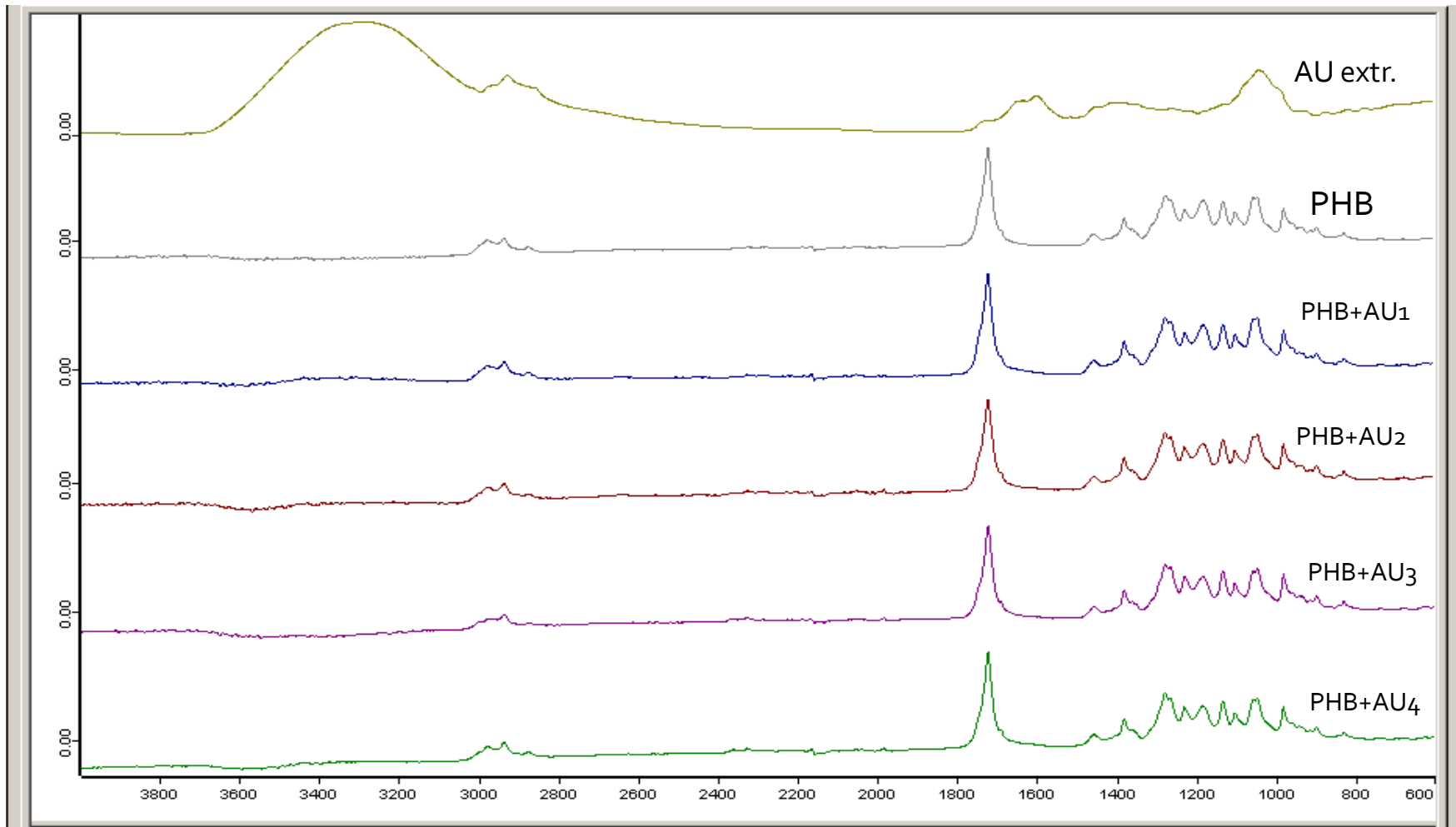
# FTIR scans of PLA mats with *Allium ursinum* extract

Changes in spectrum of the PLA loaded with AU extracts was monitored during time to understand the release of the AU extract



# FTIR scans of PHB mats with *Allium ursinum* extract

Changes in spectrum of the PHB loaded with AU extracts was monitored during time to understand the release of the AU extract



# Conclusions and final remarks



- Electrospinning was effective technique for producing films of PLA loaded with AU extract and PHB with AU, CAL and HEL extract, while for PLA loaded with CAL and HEL extract this technique was not applicable
- Different extract had different influence on prepared solution for ES, influencing the processing parameters and shape of the fibers
- For all samples transparent films were obtained with visible color change due to the extract addition
- Results concerning characterisation and antimicrobial properties will be published in joint publication

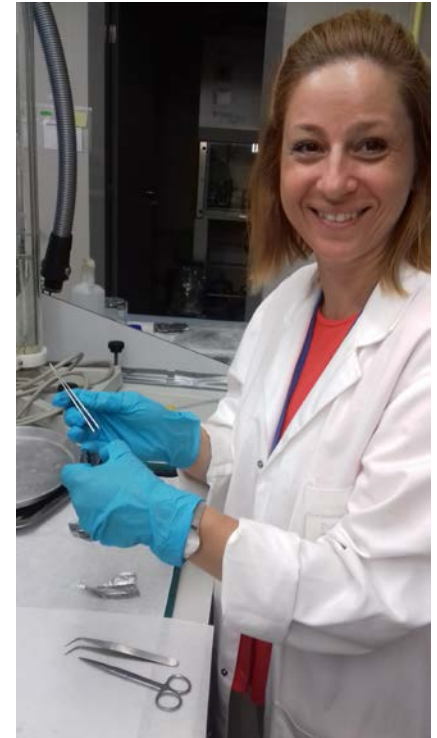
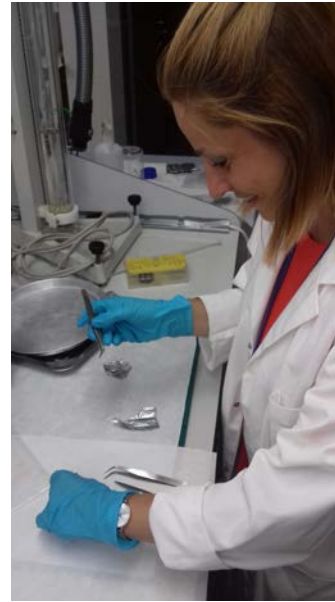
# I want to thank to...



- Professor Lagaron for the opportunity to work in his lab
- Sergio Torres on his advices and help in characterisation of prepared samples
- Adriane for her help in sample preparation
- Bea for her time and help in characterisation techniques
- Eva for helping working on SEM
- Sergio Castro on help and advices about ES



# Great team and wonderful people...





## ACKNOWLEDGEMENT

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