WP1
Summary, outcomes and future perspectives.

Dr. Marco Giacinti
University of Bologna, Italy

WP1
Next Generation barrier Packaging Composites

The main training objective of NEWGENPAK was to train **"next generation sustainable packaging researchers"** through interdisciplinary training and individual research projects.

The objectives of WP1 were then related to the development of:

i. **water-borne biopolymer-based coating systems** combining high solids content and competitive barrier properties,
ii. **a computational model** to identify the key interactions between biopolymer, plasticizer and clay that give rise to the excellent barrier properties of coatings and self-supporting films,
iii. **hybrid nanocomposite films** containing nanocellulose and nanoclays for advanced packaging applications
iv. **a gas permeation model** which can be used to deliver the desired mass transport properties of industrial nanocomposites and coatings and reliably describe critical structure-property relationships.

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FINAL TOPICS

ESR-1

- Rheological properties and microstructures of coating dispersions and their impact on the architecture of the dry coating layer.

ESR-2

- Using nanoscale computational models to probe the barrier properties of dry, clay-based coatings.

ESR-3

- Novel hybrid PLA based nanocellulose/nanoclay composites for food packaging applications.

ESR-4

- MFC-PLA multilayer films as sustainable gas barriers for packaging applications.

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OUTCOMES

ESR-1

- ✓ A novel method to produce starch-based temperature responsive silica dispersions was presented, and their rheological properties were analysed
- ✓ Information about the dispersions structure was extracted from the rheological measurements.

FUTURE PERSPECTIVES

- Analysis of Wet/Dry structure organization in starch-based temperature responsive kaolin dispersions with higher relevance to barrier coatings.
- Study of controlled release and immobilization active agent used in paper coating
- Dispersion structure control in relation to packaging design, 3D futures, etc.

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OUTCOMES

ESR-2

- ✓ Realistic computational models were produced which simulate swelling behaviour of clay in water and plasticiser and provides excellent match to experimental observations
- ✓ Direct correlation between clay layer charge, clay charge location and conformations of bio-polymer in the clay interlayer has been identified

FUTURE PERSPECTIVES

- Develop a range of realistic models for modified organo-clays to describe their influence on polymer-clay composite structure
- Develop a coarse-grained model to investigate the absorption characteristics of various types of clay
- Use of cutting edge mesoscale techniques to probe self-assembly of polymer-clay nanocomposites

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OUTCOMES

ESR-3

- ✓ New PLA – Nanoclay – NFC composites films were produced with improved:
  - Barrier properties against water and oxygen
  - Thermal Stability
  - Crystallization behaviour
- ✓ Effect of crystallinity on barrier properties was investigated and discussed

FUTURE PERSPECTIVES

- Analysis of innovative materials for active packaging applications.
- Define novel, industrially relevant, optimization strategies to enhance the barrier properties.
- Scale up the Nanocomposite production using industrially relevant procedures

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OUTCOMES

ESR-4

- ✓ MFC coated PLA films were obtained with improved O_2 barrier properties with respect to pure biopolymer which are maintained up to 60% RH.
- ✓ Water sorption and diffusion in MFC can be correlated to O_2 permeation data through a simple phenomenological model.

FUTURE PERSPECTIVES

- Define protocols and procedures to produce multilayer films. Scaling up the production process.
- Study the physical meaning of different parameters of the initial model in order to obtain reliable structure-properties relationships

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OUTCOMES

The objectives of WP1 were then related to the development of:

i. water-borne biopolymer-based coating systems with high barrier properties
ii. hybrid nanocomposite films for packaging application
iii. a computational model for clay based nanocomposites
iv. a gas permeation model for nanocomposites and coatings

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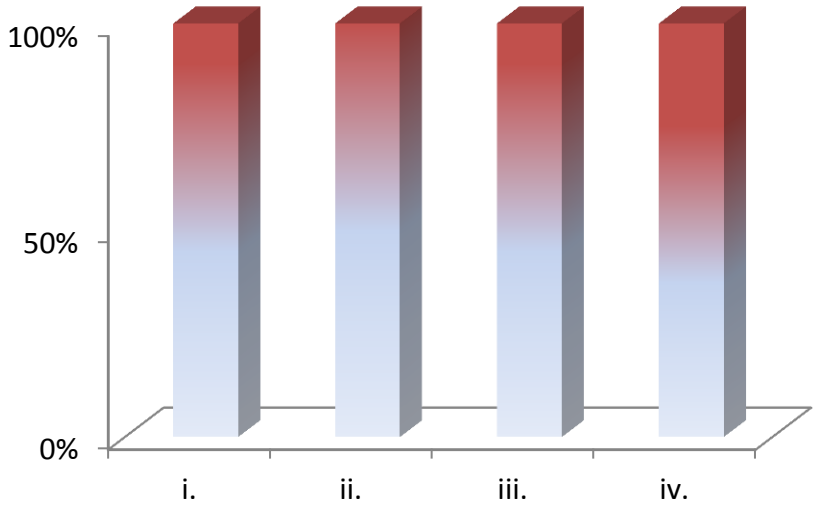

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OUTCOMES

The main training objective of NEWGENPAK was to train "next generation sustainable packaging researchers" through interdisciplinary training and individual research projects.

Young researchers with:

- ☑ **High independence in research and laboratory activities**
- ☑ **High level of interdisciplinarity**
- ☑ **Positive working attitude**
- ☑ **Good social skills**
- ☑ **Experience in presenting and discussing their work**

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FUTURE PERSPECTIVES

Promoting the bio-based economy for a better world.

Continuing my career in the research and development of sustainable packaging materials.

Going to long vacation in a warm country.

Find a position related to my research field in academia/industry.

Looking for new opportunities in academia.

Carrying on with honing and developing new skills and knowledge for the sake of usefulness.

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Thank you