Finanziato dall'Unione europea
NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA
agritech
National Research Center for Technology in Agriculture

FROM POMACE-WASTE TO FIELD REUSE: A NEW BIOPOLYMER FOR MULCHING APPLICATION

Oliviero M[1] (Consiglio Nazionale delle Ricerche), Manna P[2] (Consiglio Nazionale delle Ricerche, Pisano L[2] (Consiglio Nazionale delle Ricerche), Russo N[1] (Consiglio Nazionale delle Ricerche) and Monaco E[2] (Consiglio Nazionale delle Ricerche)

[1] Consiglio Nazionale delle Ricerche, Istituto per I Polimeri Compositi e i Biomateriali, Piazzale E. Fermi 1, 80055 Portici (Na);
[2] Consiglio Nazionale delle Ricerche, Istituto per I Sistemi Agricoli e Forestali del Mediterraneo, Piazzale E. Fermi 1, 80055 Portici (Na);

E-mail:
eugenia.monaco@cnr.it

Consiglio Nazionale delle Ricerche
CNR - ISAFOM
IPCB ISTITUTO PER I POLIMERI COMPOSITI E BIOMATERIALI

SPOKE, WP E TASK DI APPARTENENZA

SPOKE 8 – Circular Economy in agriculture trough waste valorization and recycling ; WP 8.1 Producing new products to upgrade waste value; Task 8.1.3 Valorization of the waste to obtain biomaterials

ABSTRACT

One of the objectives of the new CAP is to increase circular economy practices within farms. The European Commission adopted the new Circular Economy Action Plan (CEAP) in March 2020. This plan is one of the main pillars of the European Green Deal, Europe's new agenda for sustainable growth. The EU's transition to a circular economy will reduce pressure on natural resources and foster sustainable growth. It is also essential for achieving the EU's 2050 climate neutrality target and for halting biodiversity loss. In this context, the proposed case study could be significant in terms of farm waste reuse.

The aim of the work was to produce a biopolymer for mulching, starting from grape pomace waste.

Grape pomace (GP), an abundant byproduct of the wine industry, was used as a filler in a thermoplastic Cellulose Acetate (CA) matrix to enhance its value and improve the sustainability of the blends. GP-reinforced composites were prepared with varying amounts of filler, up to 50% GP by weight. The results obtained show promising performance for the biofilm, especially at lower percentages of pomace waste.

MATERIALI E METODI

1. Materials: Cellulose Acetate (CA) was used as the primary material in the form of pellets, provided by GIBAPLAST. Grape pomace (GP), obtained from the drying of Aglianico grape bunches, was used as a filler.

2. Preparation of Composite Bioplastics:

• **Grape Pomace Preparation**: The grape pomace was sourced from Aglianico grapes grown in Irpinia (Montemiletto, AV). The grape was dried at 60°C for 72 hours until the moisture content was below 2.5%, then the pomace was milled using a grinding machine;


1. the vine field


2. Grape Pomace (GP)


3. Biofilm (30%GP)

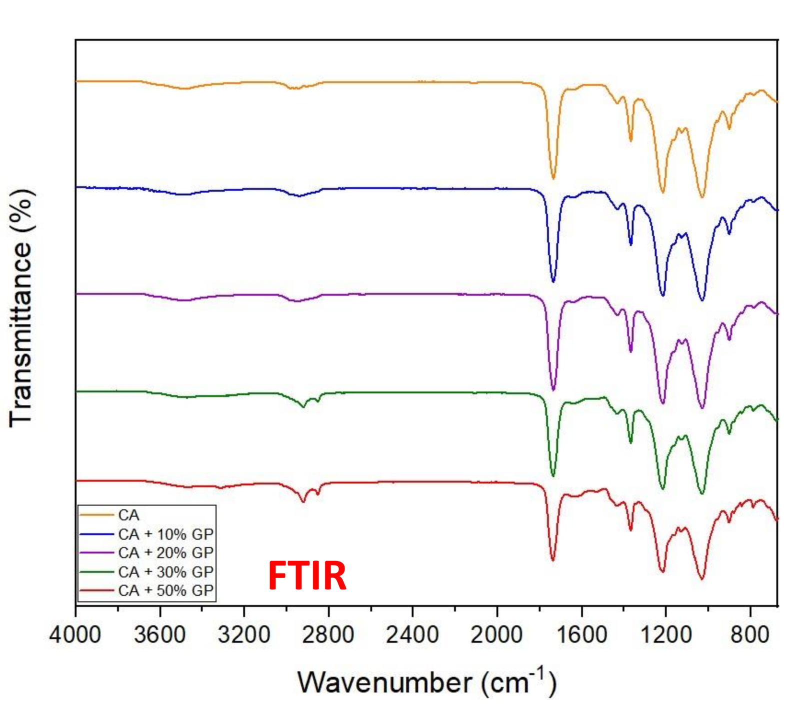

4. Soil covered with biofilm

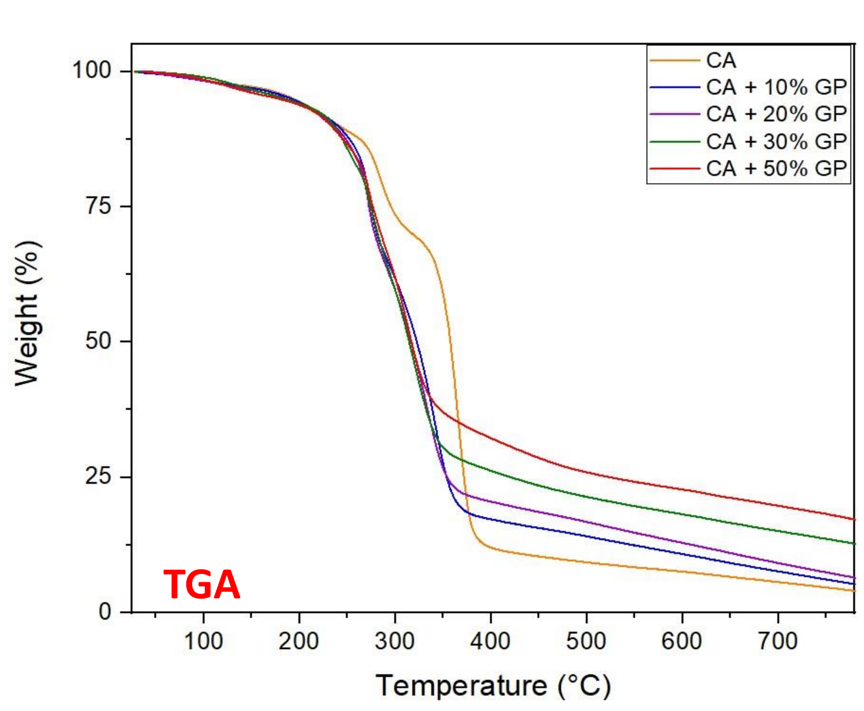
• **Composites Preparation**: CA-GP composites were made by melt mixing. Grape pomace was mixed with CA in varying concentrations (10%, 20%, 30%, and 50%). The mixture was manually blended and then processed in a Rheomix internal mixer at 150°C, 50 rpm, for 10 minutes. The molten composites were compression-molded into films at 170°C and 50 bar. Pristine CA was also processed similarly for comparison.

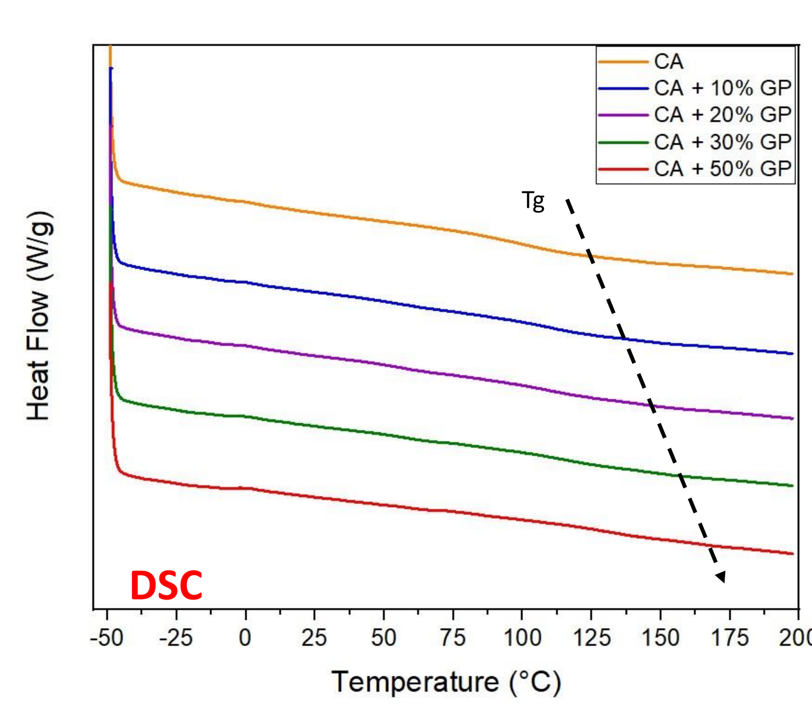
3. Characterization of Composite Bioplastics:

•FT-IR Analysis
•Thermal Analysis (TGA and DSC)
•Mechanical Measurements

RISULTATI







FTIR measurements show that there is no chemical bonding between the filler GP and the matrix CA. TGA results show that the GP was thermally stable at processing conditions. In fact, the grape pomace only starts degrading around 200 °C and it is processed at 150 °C. The onset temperature for thermal degradation was lower for the composites than for pristine CA which can be attributed to the decreased thermal stability of GP. Also, the incorporation of the pomace can reduce the amount of movement from the polymer molecules, with consequent shift in the glass transition temperature (Tg) to higher temperatures as recognized by many researchers.

Mechanical properties

Sample	Elastic modulus (E) (Mpa)	Stress at break (Mpa)
AC	906,88 ± 18,31	22,08 ± 0,49
AC + 10% GP	979,45 ± 98,91	18,54 ± 3,29
AC + 30% GP	906,07 ± 7,20	7,9 ± 1,24

The mechanical properties of green composites are influenced by the dispersion of the filler in the matrix. The elastic modulus increased, in particular, at low GP content (10 wt %), confirming the reinforcing effect of the pomace. However, a further increase of GP content resulted in a decrease of the E. Probably, as the GP content increased, phase separation occurred in the biocomposites.

REFERENZE

1. F. Biagi, A. Giubilini, P. Veronesi, G. Nigro, M. Messori, Valorization of Winery By-Products as Bio-Fillers for Biopolymer-Based Composites, Polymers (2024), 16(10): 1344.
2. M. Oliviero, E. Lamberti, Elena, L. Cafiero, B. Pace, M. Cefola, G. Gorrasi, A. Sambandam, A. Sorrentino, Biodegradable cellulose acetate/layered double-hydroxide composite film for active packaging of fresh food, Materials Chemistry and Physics (2023): 310, Article number 128469.

This study was carried out within the Agritech National Research Center and received funding from the European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 1032 17/06/2022, CN00000022). This manuscript reflects only the authors' views and opinions, neither the European Union nor the European Commission can be considered responsible for them.