

# Wine not?!

## Wine By-Products as Sustainable Polymer Stabilizers

### FoB:Plast – Future of BioPlastics

Ceresana, June 25, 2026 (online)

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# INSTITUTE FOR CIRCULAR ECONOMY OF BIO:POLYMERS



„Together Toward a Sustainable Future“



Engineering of Bio:Polymers and Bio:Composites



Polymer Degradation, Restabilization and Recycling Technologies



Natural Material Composites



AI-Enabled Circular Design

founded in 2018

currently 30 members & 16 running projects

# biopolyesters

the sustainable alternative?

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- commercially available biobased alternatives such as PBS
- feasible for state-of-the-art processing

**BUT:** prone to degradation mechanisms – especially thermo-oxidative degradation



**addition of stabilizers such as antioxidants**

**BUT:**

- comparable toxicity of conventional & biobased plastics
- conventional additives and not the matrix as the cause of hazardous effects
- **harmful to soil, plants, soil fauna & human health**

# why to choose wine?

utilization of wine by-products as additives

- **secondary phytochemicals in various combinations**  
*natural radical scavengers & antioxidants*

- **bio-economical benefits**  
*large quantities & regional availability & currently poor utilization*

- **wine by-products in polymers**  
*low-cost non-functional fillers without additional functionality*

## research gap

- feasibility – by-products as functional stabilizing fillers
- reliability – impact of annual variations on performance
- optimization – comparison with conv. stabilizer & improvements

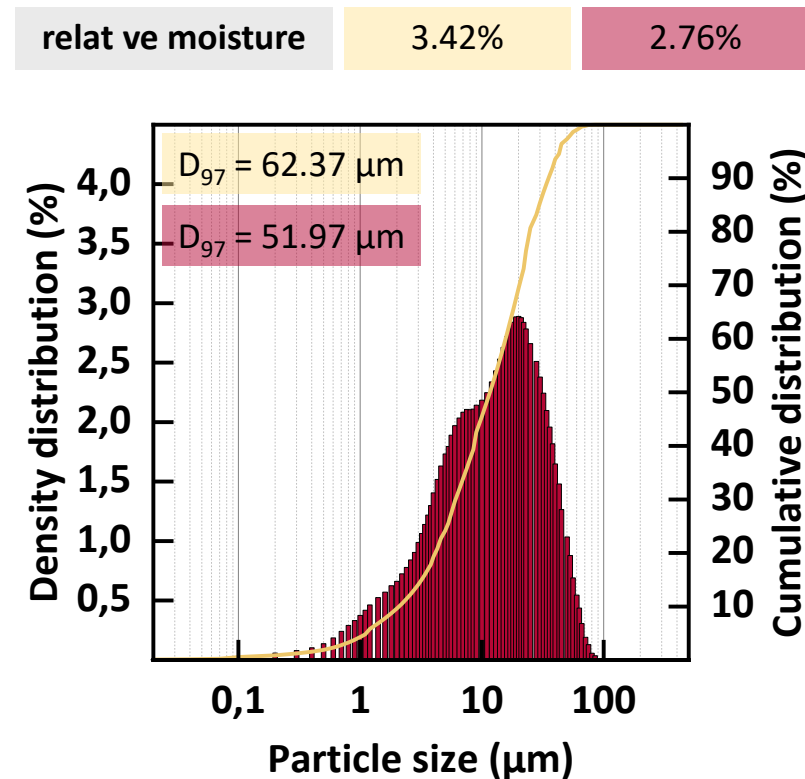


# FROM BY-PRODUCT TO BIOCOMPOUND

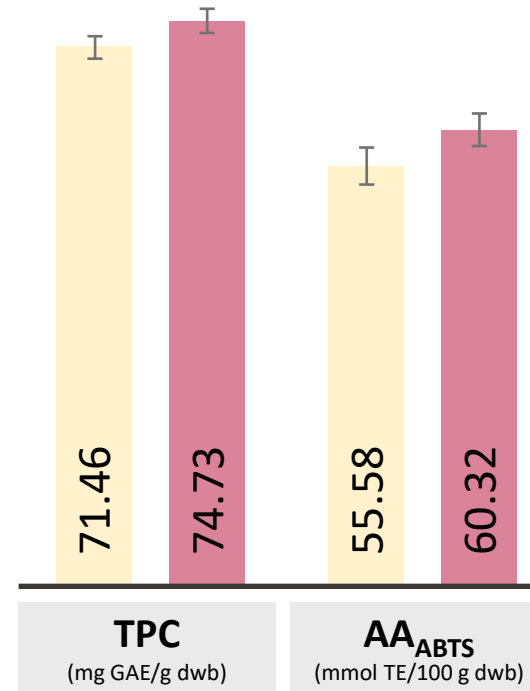
# feasibility

wine grape pomace filler properties & resulting biocompound stability

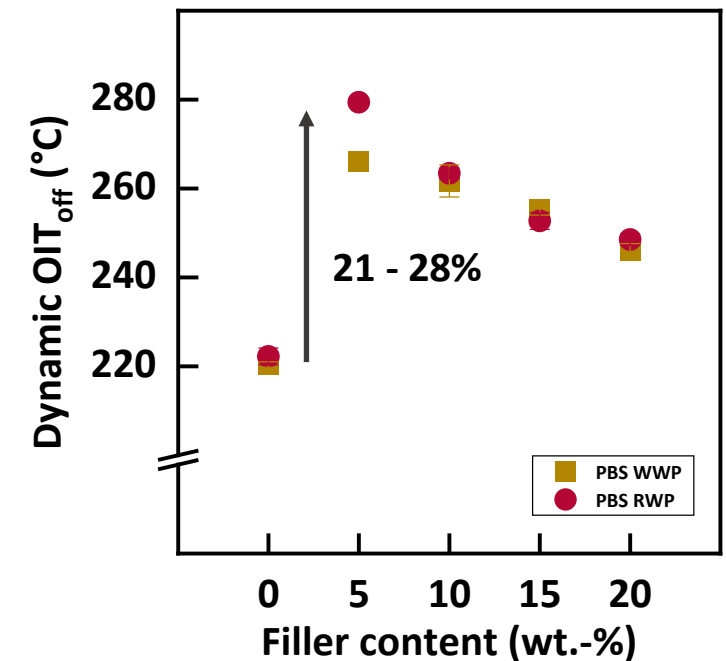
## PHYSICAL PROPERTIES



## FUNCTIONALITY



## DYNAMIC OIT





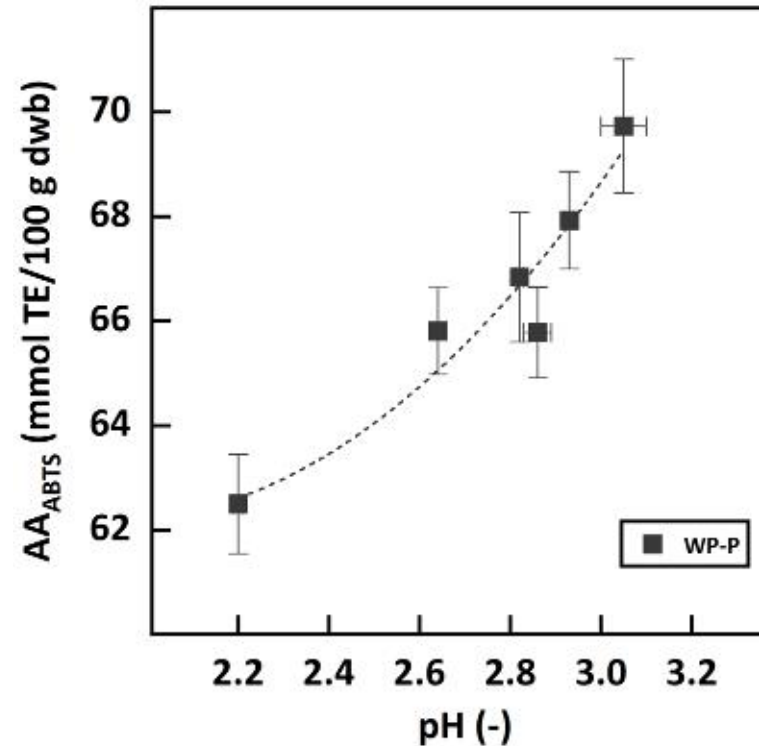
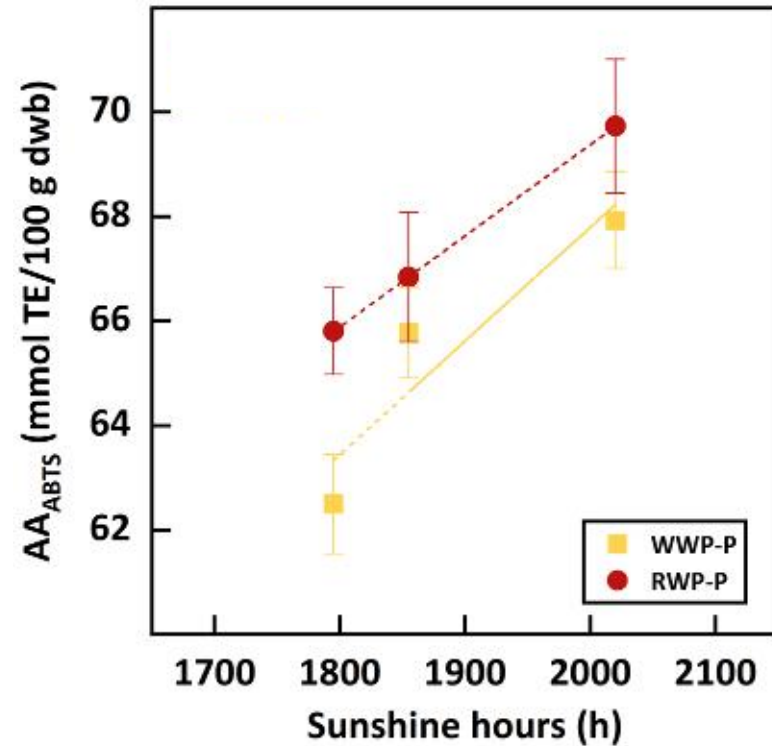
# RELIABILITY

What are the **differences** in wine pomace of different **vintages**?

Is wine pomace a **reliable stabilizer** for biopolymers?

# reliability

biochemical filler properties vs. cultivation conditions



more sunshine hours and higher pH-values lead to increased antioxidant activity

*Meteorological data: Deutscher Wetterdienst (DWD: German Meteorological Service) for the associated weather station (ID 6347)*

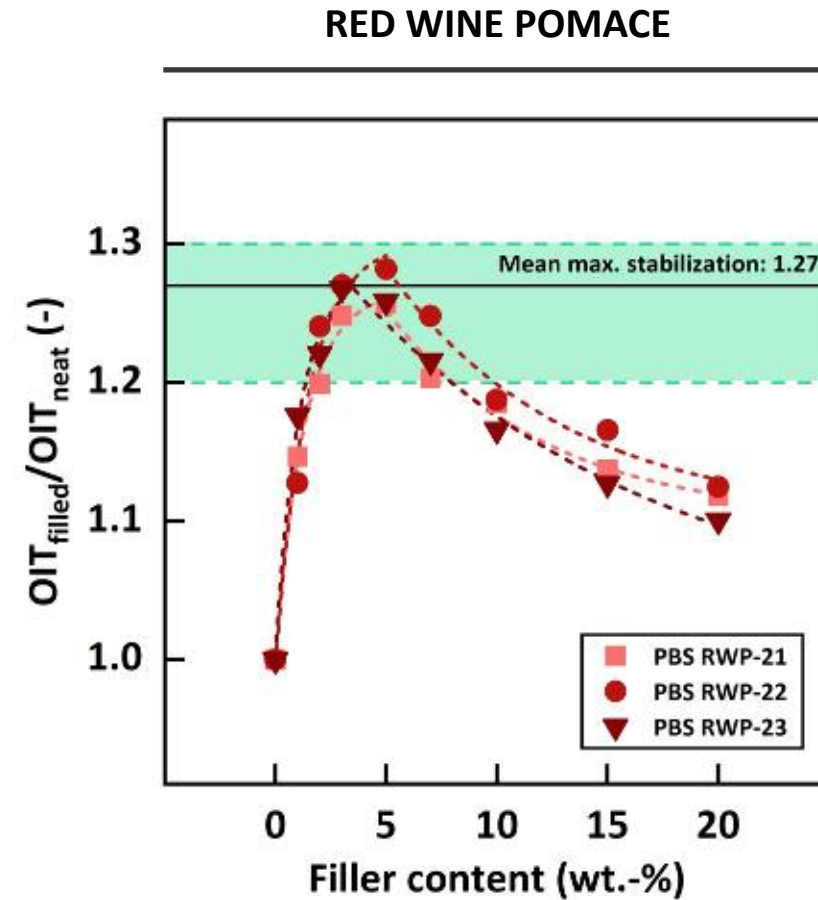
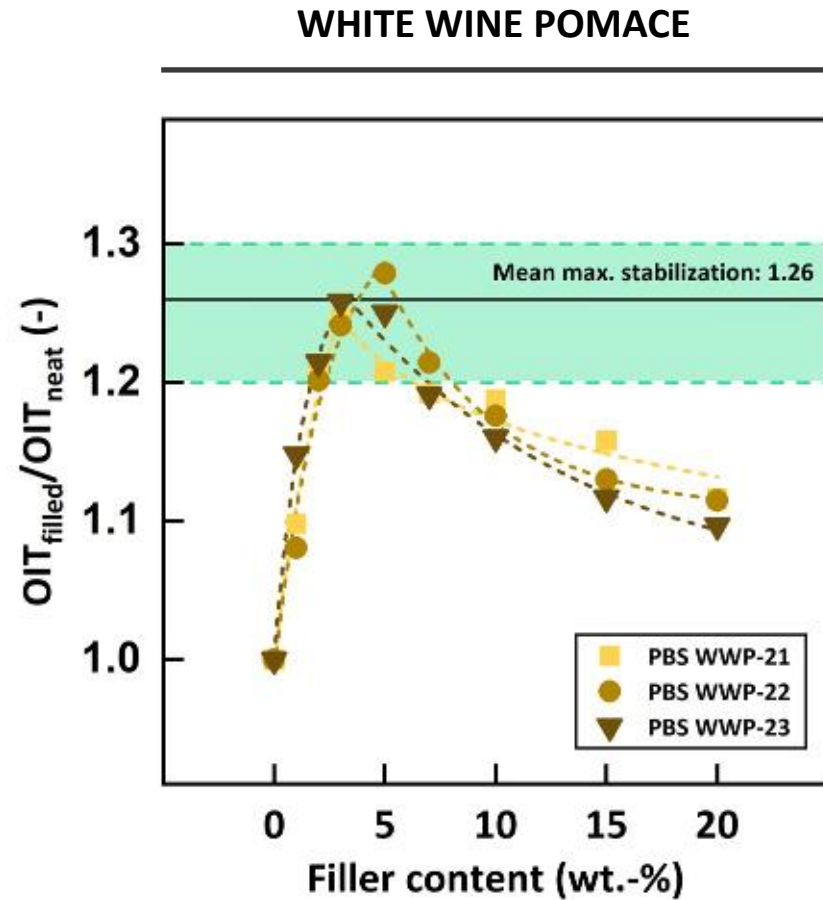
*AA<sub>ABTS</sub>: ABTS-Assay; standard: trolox; solvent: bio-ethanol & distilled water 1:1 (v/v); sonicated at 50 °C & 600 W for 1 h; dilution: 1:50 (v/v); incubation: 6 min; absorption at 734 nm; n = 2*

*pH: according to method L 31.00-B; sample mass = 10 g; solvent: 90 ml distilled water; n = 2*

*FoB:Plast – Ceresana – online – 25.06.26 – Benedikt T. Hiller – ibp*

# reliability

thermo-oxidative stability of PBS filled with WP – dynamic OIT



Thermal analysis of BioPBS FZ71PM filled with White Wine Pomace (WWP) or Red Wine Pomace (RWP) of the Vintages 2021, 2022 and 2023

Dyn. OIT: sample mass = 5.0 ± 0.5 mg; temperature range = 25-330 °C; heating rate = 20 K/min; O<sub>2</sub> flow = 50 mL/min; n = 3

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# OPTIMIZATION TRANSFERABILITY &

Is there a **performance gap** between  
**biobased & synthetic antioxidants?**

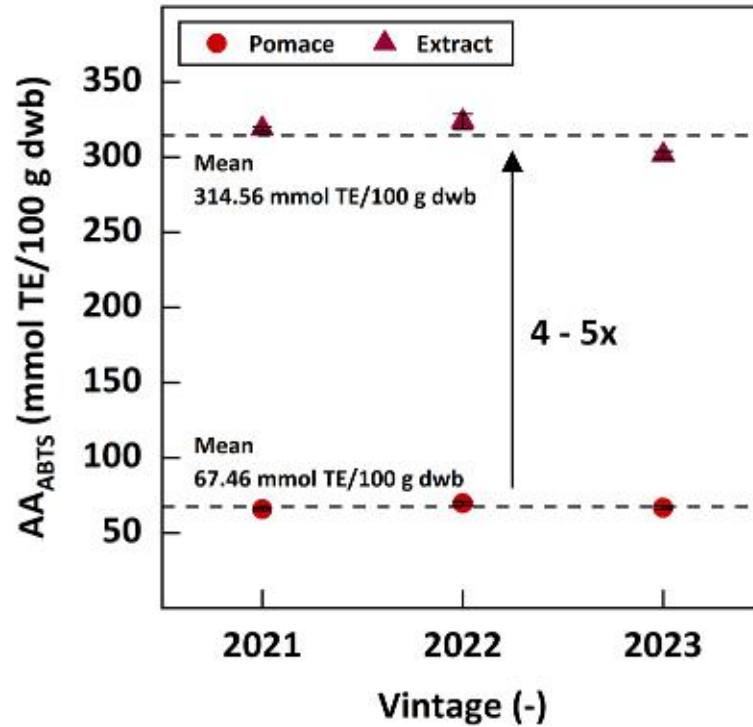
Can **extraction** increase the  
**effectiveness** of the bio-stabilizers?



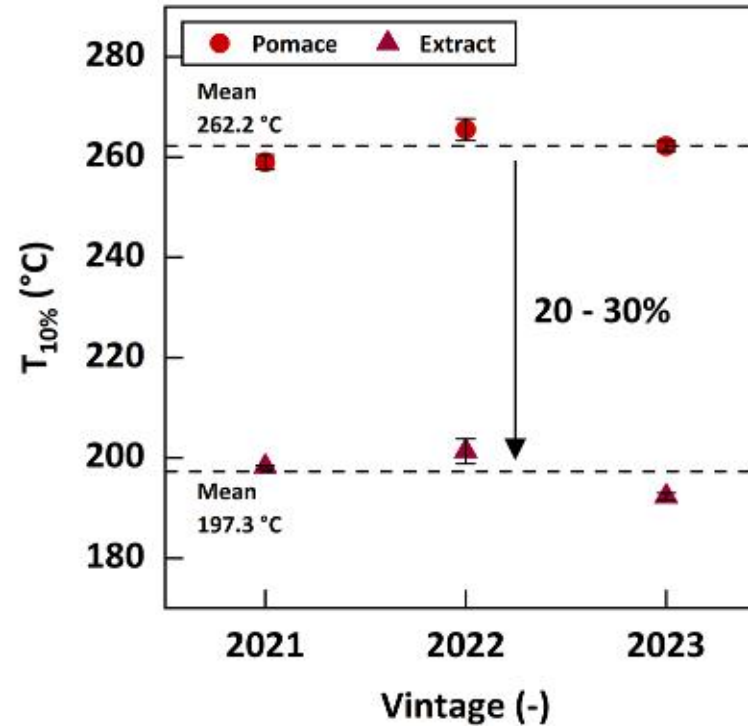
# opt mizat on

comparison of wine grape pomace powders & their extracts

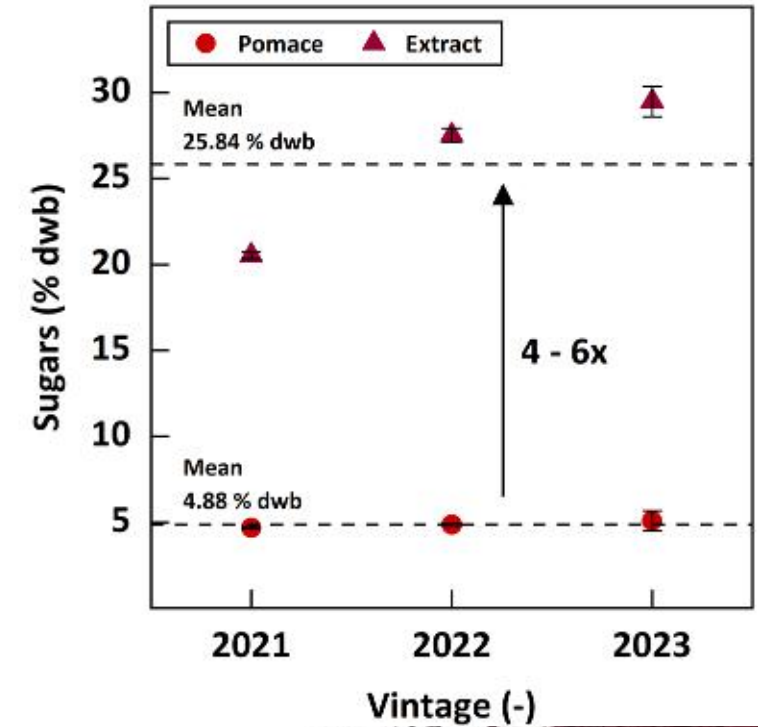
## ANTIOXIDANT ACTIVITY



## THERMAL STABILITY



## SUGAR CONTENT



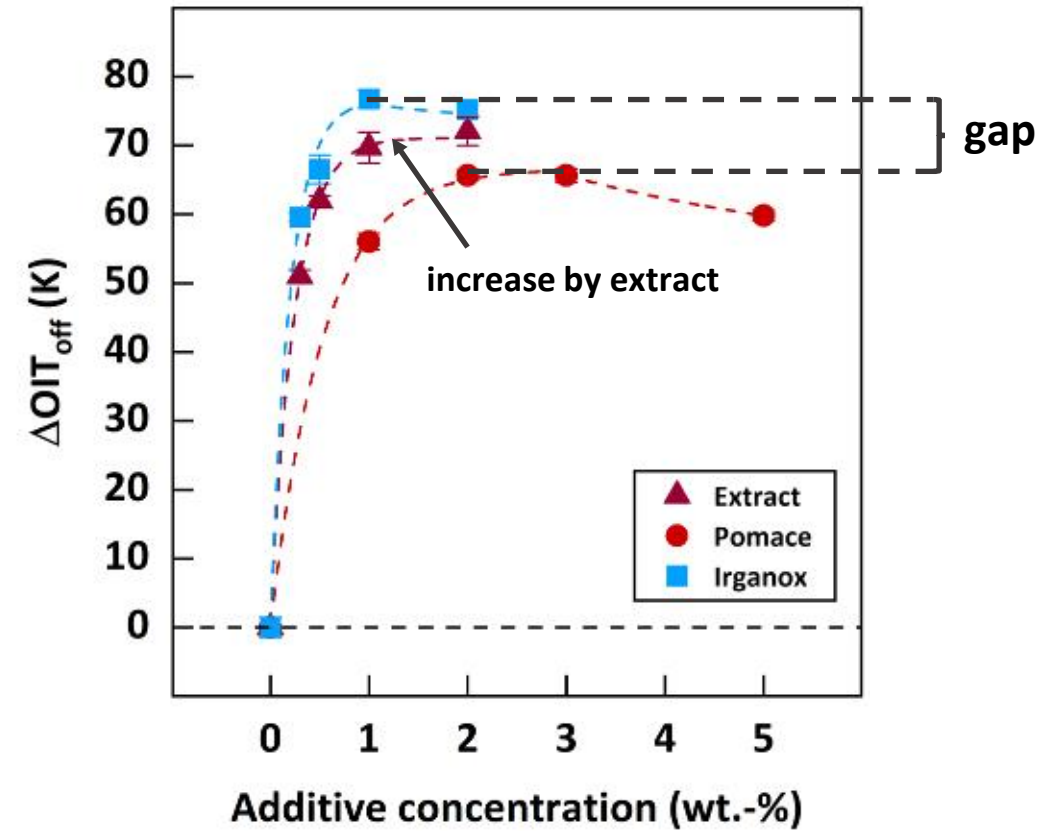
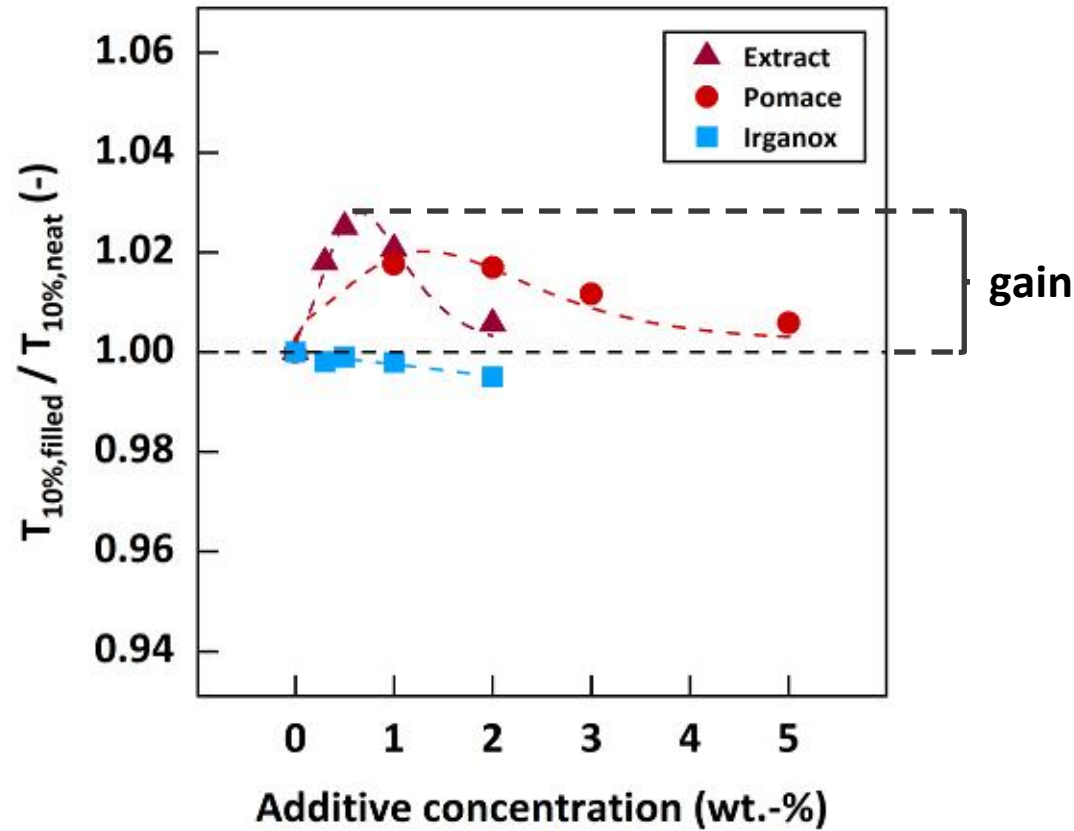
*AA<sub>ABTS</sub>*: ABTS-Assay; standard: trolox; solvent: bioethanol & distilled water 1:1 (v/v); sonicated at 50 °C & 600 W for 1 h; dilution: 1:10 (w/v); incubation: 6 min; absorption at 734 nm; n = 2

*TGA*: sample mass = 9.5 ± 0.5 mg; temperature range = 40-900 °C; heating rate = 10 K/min; N<sub>2</sub> flow protective = 20 mL/min; n = 2

*Sugars*: determined by Luff-Schoorl-method; sample mass = 5 g; 100 ml distilled water; back-titration with sodium thiosulphate against starch; n = 2

# opt mizat on

thermal & thermo-oxidat ve stability of PBS f lled with addit ves



Thermal analysis of BioPBS FZ71PM filled with red wine grape pomace powder from 2022, its extract, and Irganox 1010

TGA: sample mass =  $9.5 \pm 0.5$  mg; temperature range = 40-600 °C; heating rate = 10 K/min;  $N_2$  flow protective = 20 mL/min;  $N_2$  flow protective = 20 mL/min; n = 2

Dyn. OIT: sample mass =  $5.0 \pm 0.5$  mg; temperature range = 25-330 °C; heating rate = 20 K/min;  $O_2$  flow = 50 mL/min; n = 3

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Economy of Bio-Polymers  
at Hof University



# CONCLUSIONS

FEASIBILITY

RELIABILITY

OPTIMIZATION

# conclusions

feasibility | reliability | optimization

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## *does it work?*

- viable preparation method & high antioxidant activities of bio-fillers
- successful bio-filler incorporation & thermo-oxidative stabilization

## *is it reliable?*

- differences in biochemical properties in correlation with weather data
- stabilization by at least 25% regardless of variety & vintage

## *can it be optimized?*

- stabilization efficiency improved by environmentally-friendly extraction
- effects comparable to conventional synthetic antioxidant





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# THANK YOU FOR YOUR ATTENTION!

more information

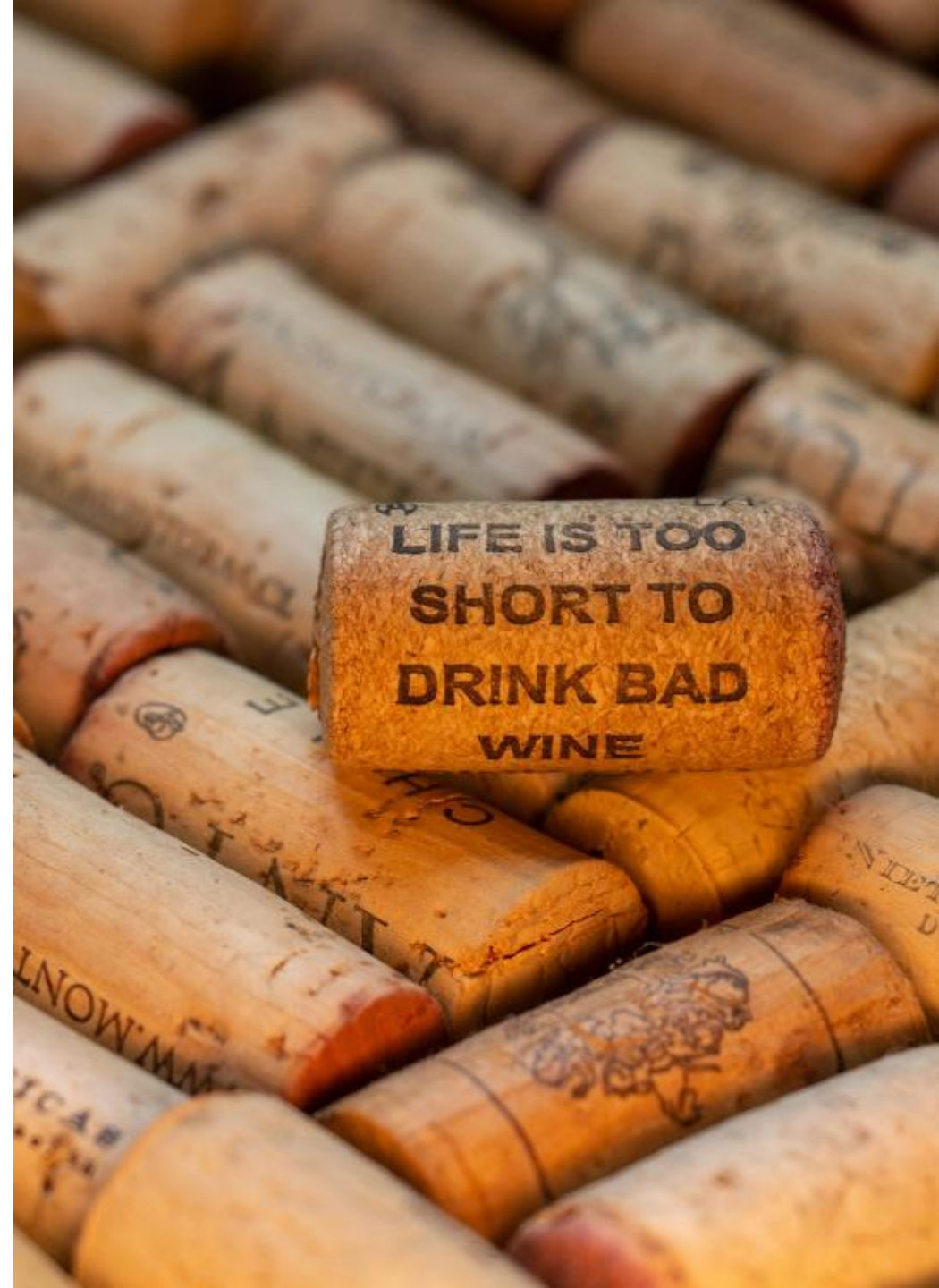


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