Fundamentals of Brightness Reversion

Mechanical Pulps

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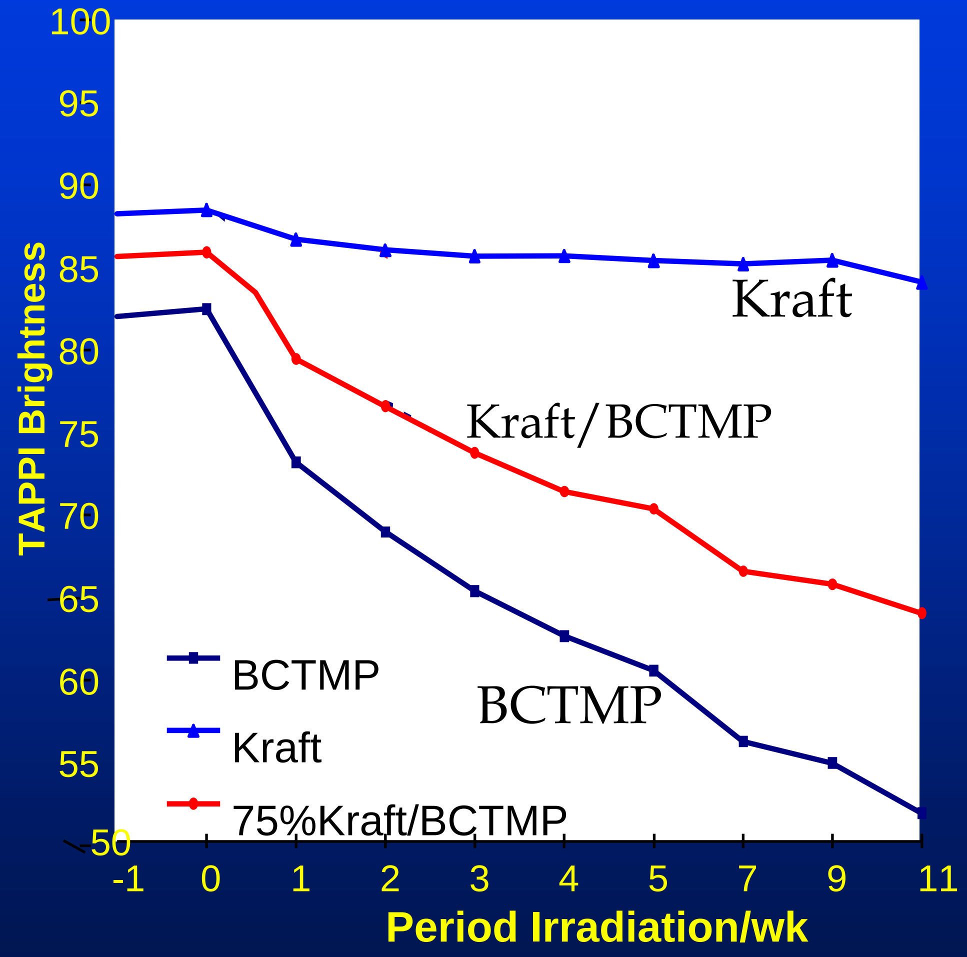
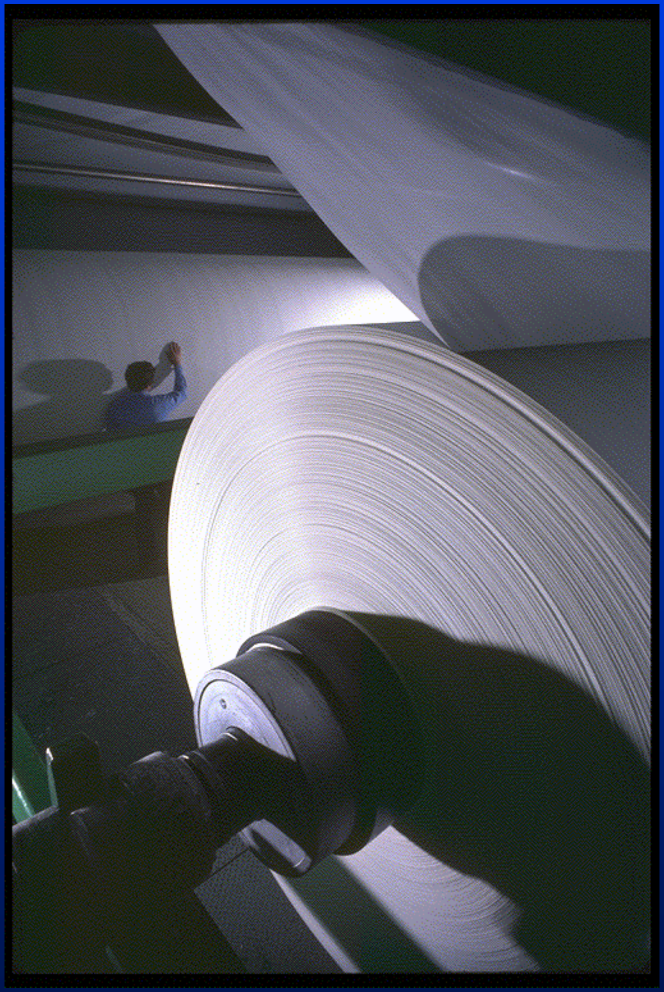
Reversion Studies: Project Objective

Research efforts are directed at investigating (i) the fundamental chemical reactions that are initiated when high-yield pulps are photolyzed and (ii) technologies for retarding brightness reversion



Current Research Focus

- Photostabilization Additives
- Application Technologies
- Photoreversion chemistry of acetylated lignin



Research Highlights

- Study photoreversion of 75:25 SW Kraft - HW BCTMP handsheets with $CaCO_3$ and TiO_2
- Examine role of FWA/co-additives with BCTMP to retard brightness reversion
- Examine the photostabilization chemistry of acetylated BCTMP.

Lignin Acetylation

Experimental Procedure

BCTMP sheet ⟶ Acetylated Sheet

$AcOH/Ac_2O$

100^oC

15 minutes

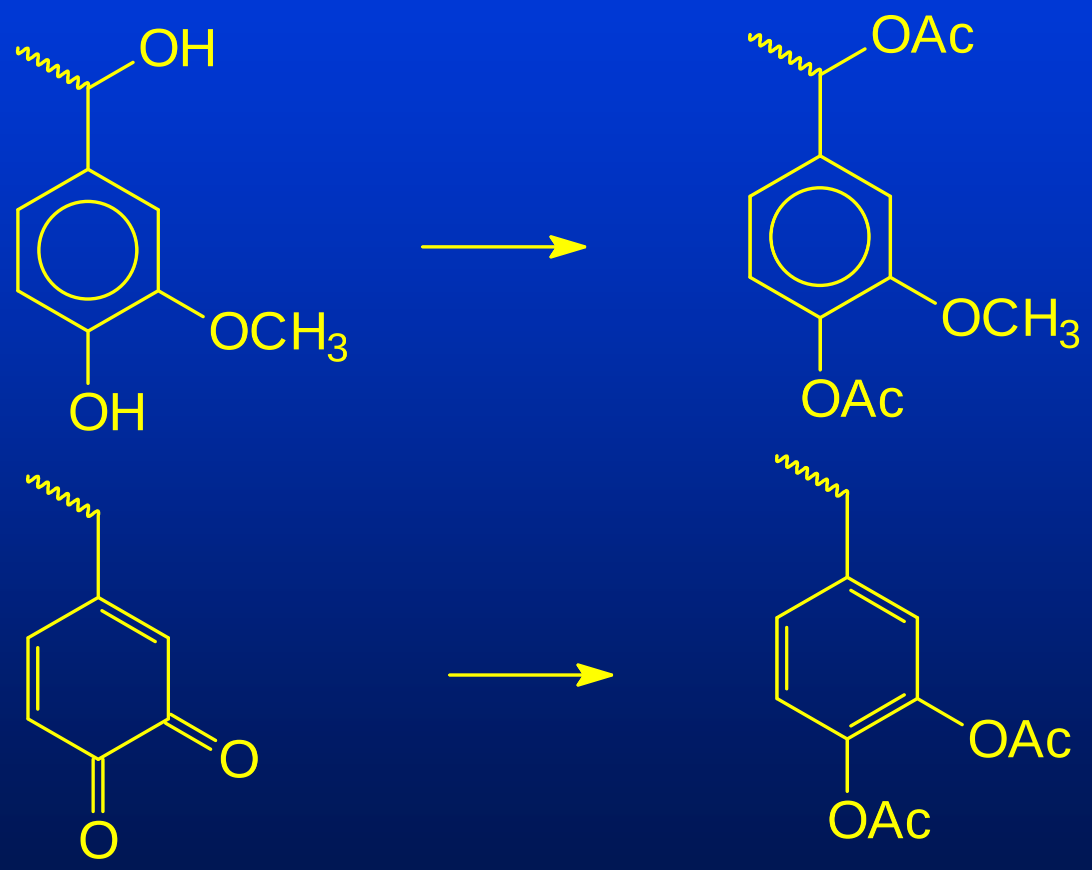
Previously employed with TMP, GSW

shown to retard brightness reversion

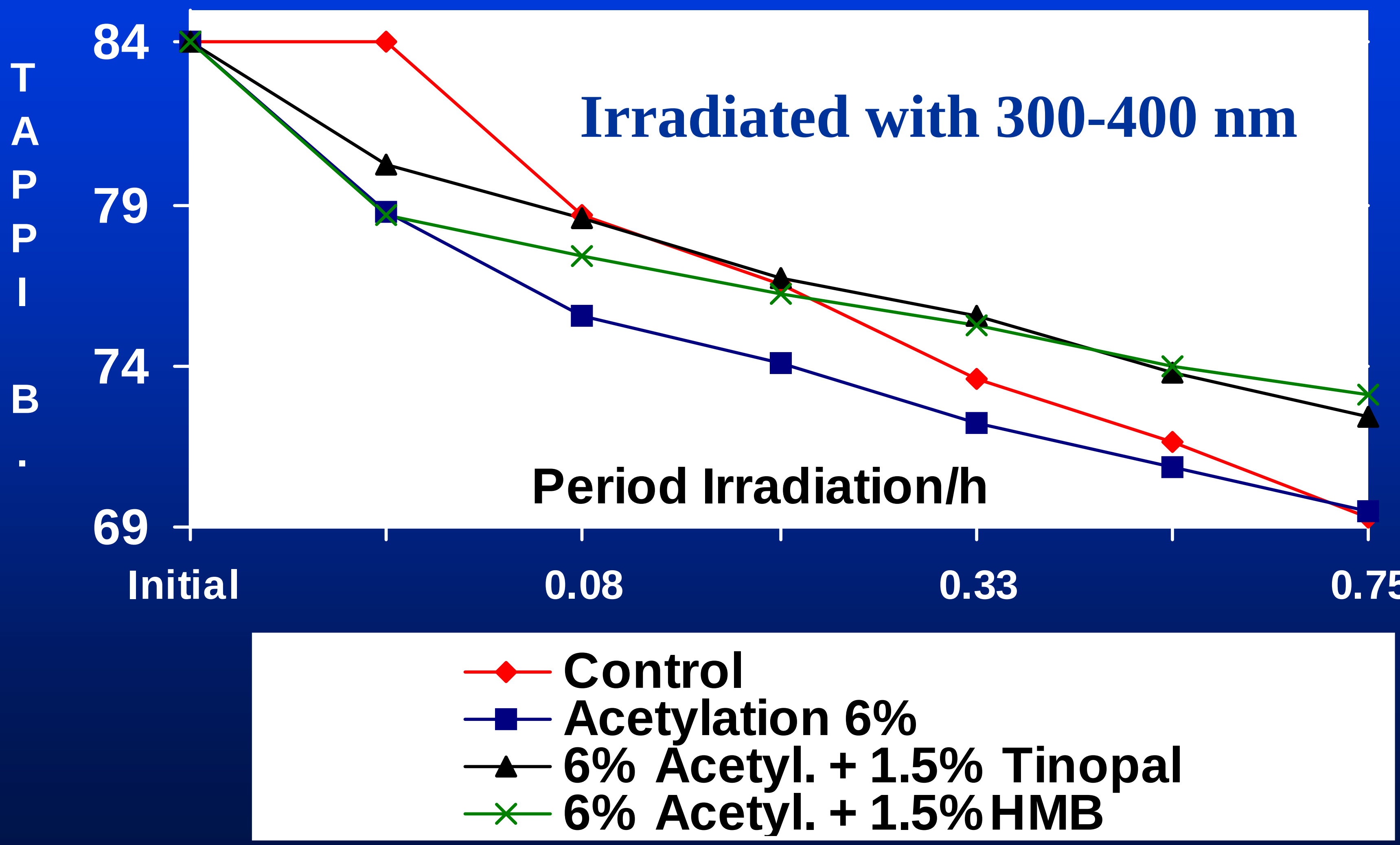
enhance wet strength

Alternative Approach: Lignin Acetylation

Chemistry



Lignin Acetylation: BCTMP Reversion Results



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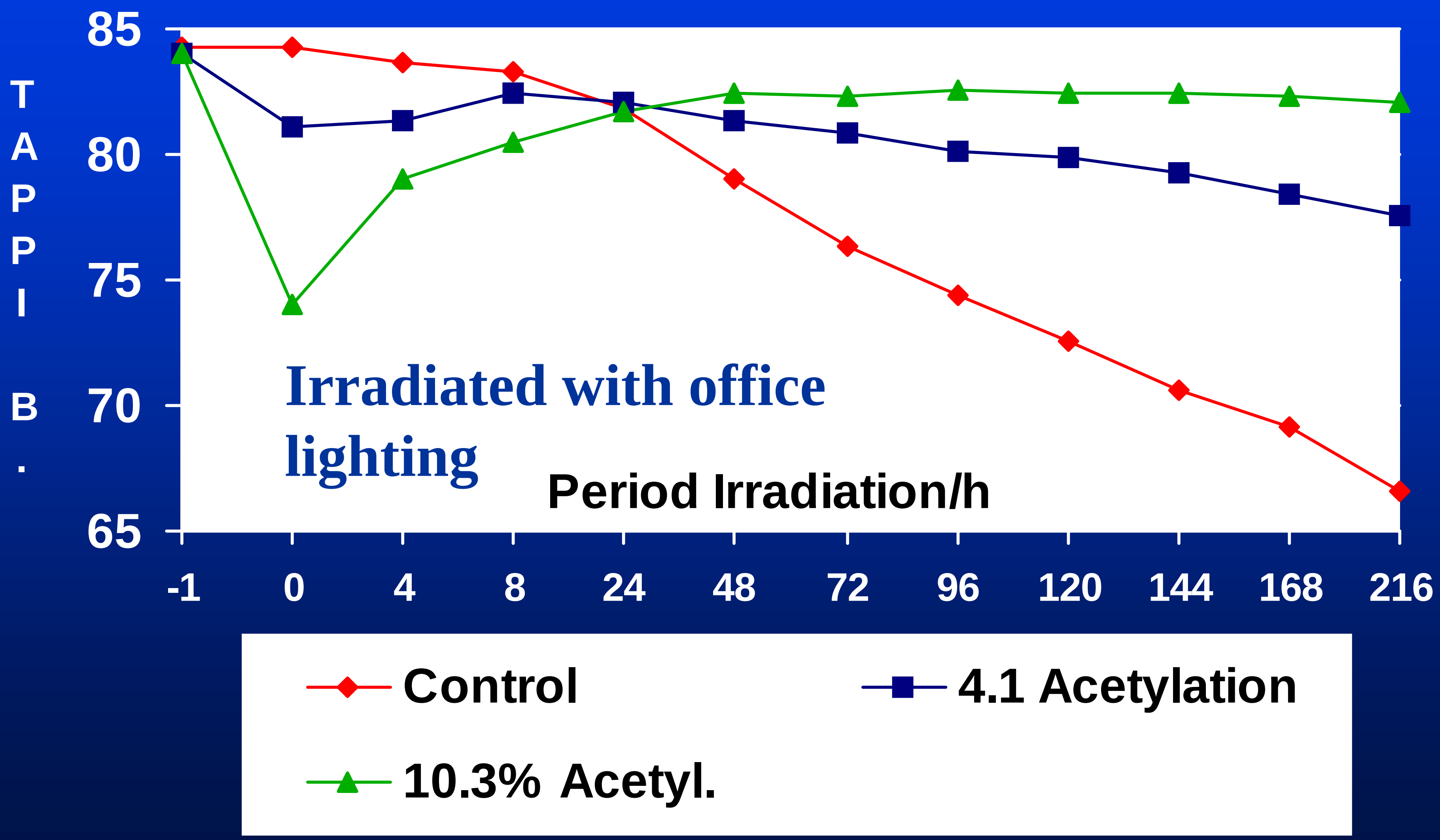


Summary of Lignin Acetylation: Summary

Acetylation causes drop in initial brightness

Acetylation reduces photoyellowing

Acetylation process works favorably with photostabilization additives:

- OBAs, UV-absorbers
- PEG, Polytetrahydrofuran

Equally effective for TMP SW and HW

Understanding fundamental chemistry could provide new opportunities

Performance
of
FWA Treated
High - Yield Pulp

Prior Results

- FWA especially Tinopal & Phorwite UW enhance initial brightness
- Provide +80 brightness for ca. 20 days continuous irradiation
  - Tappi brightness, L*a*b*, Abs.Scatt. Coeff
- Low charges of PEG improve performance of FWA
- Storage in dark or light/dark cycling does not influence FWA photostabilization effect
- FWA effect same for office light & sunlight

Prior FWA - Synergistic Effects

25%BCTMP/kraft

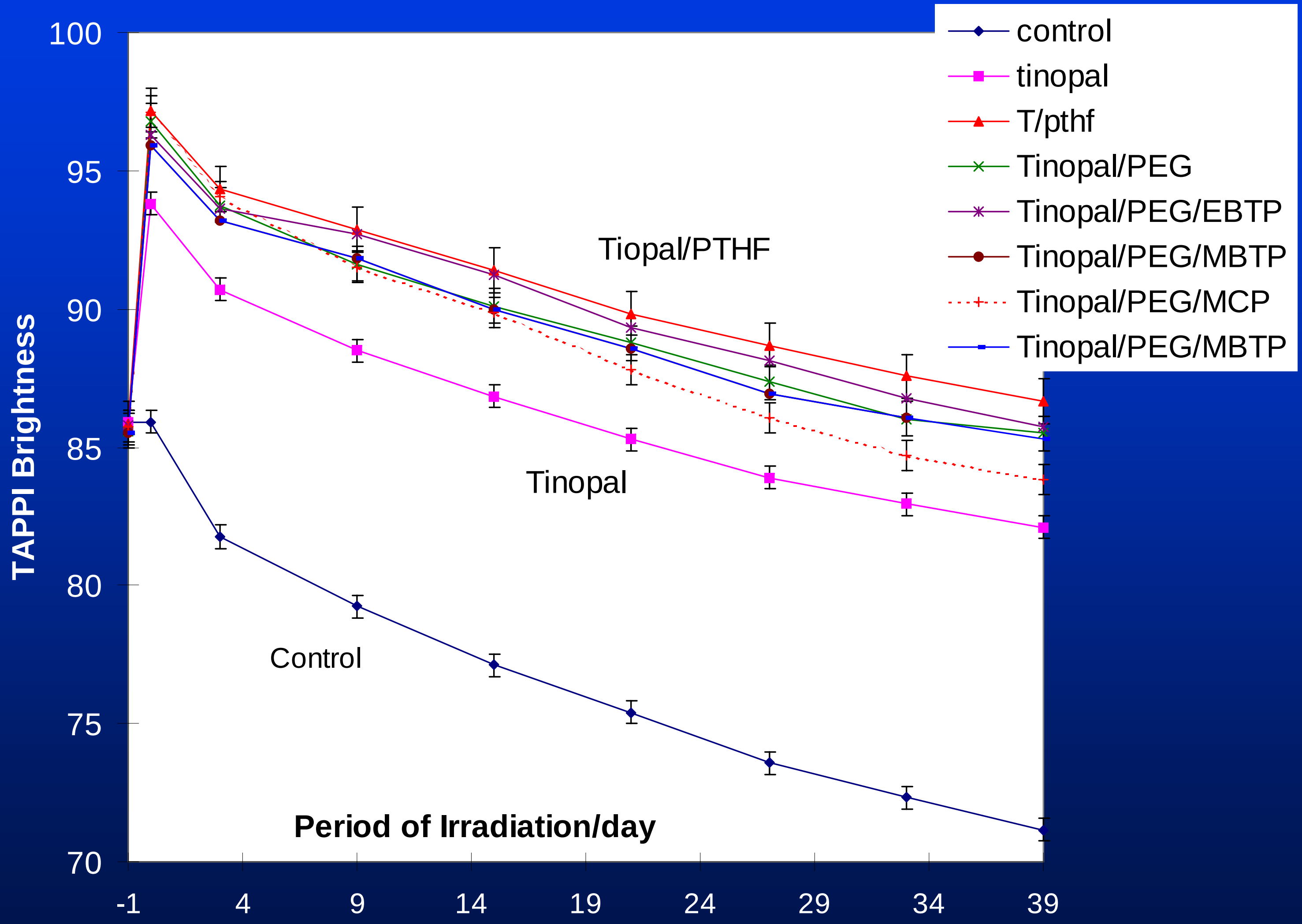
1.0% UW

1.0% PEG

3.3% PTHF

1.0% ETBP

1.0% MTBP



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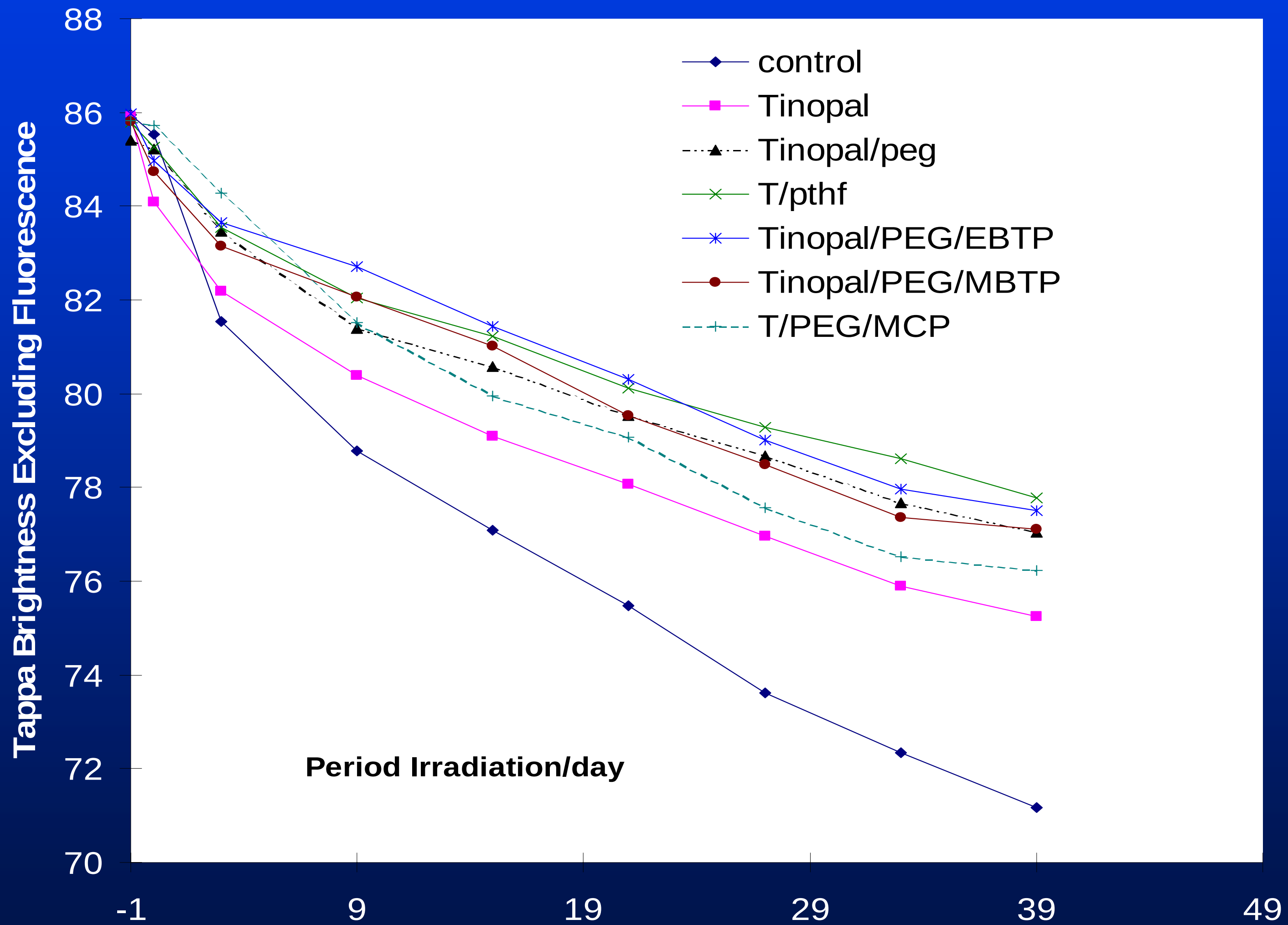
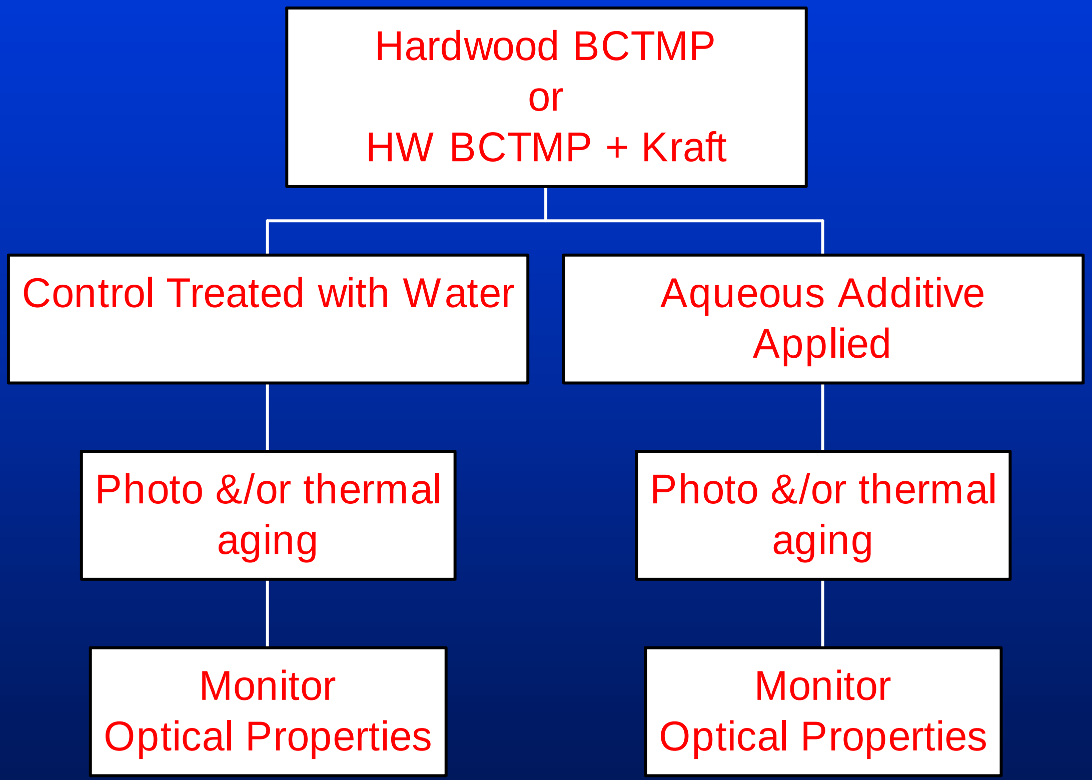
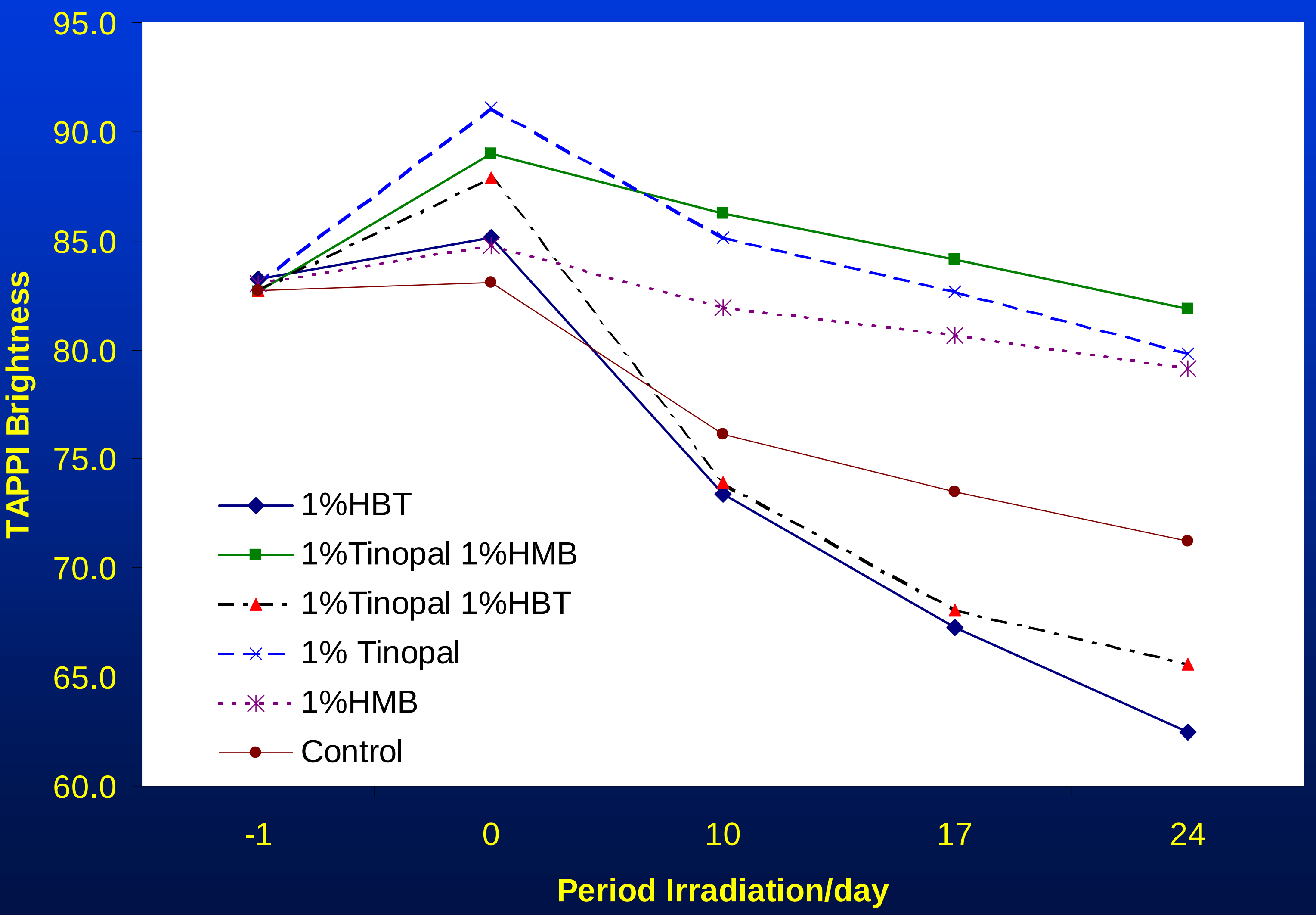


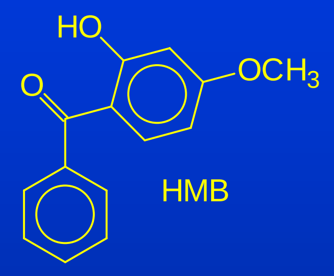
FWA /co-additive Photostabilization Results

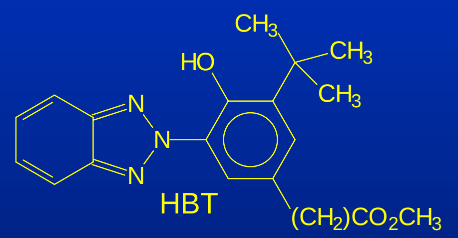
- Study photostabilization effects of:
  - Tinopal
  - hydroxybenzophenone
  - hydroxybenzotriazole

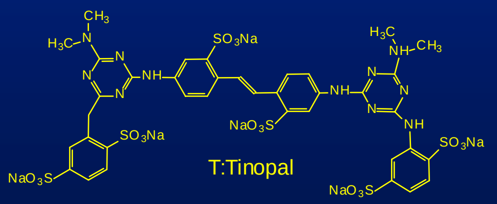


BCTMP: FWA + UV Absorber Studies









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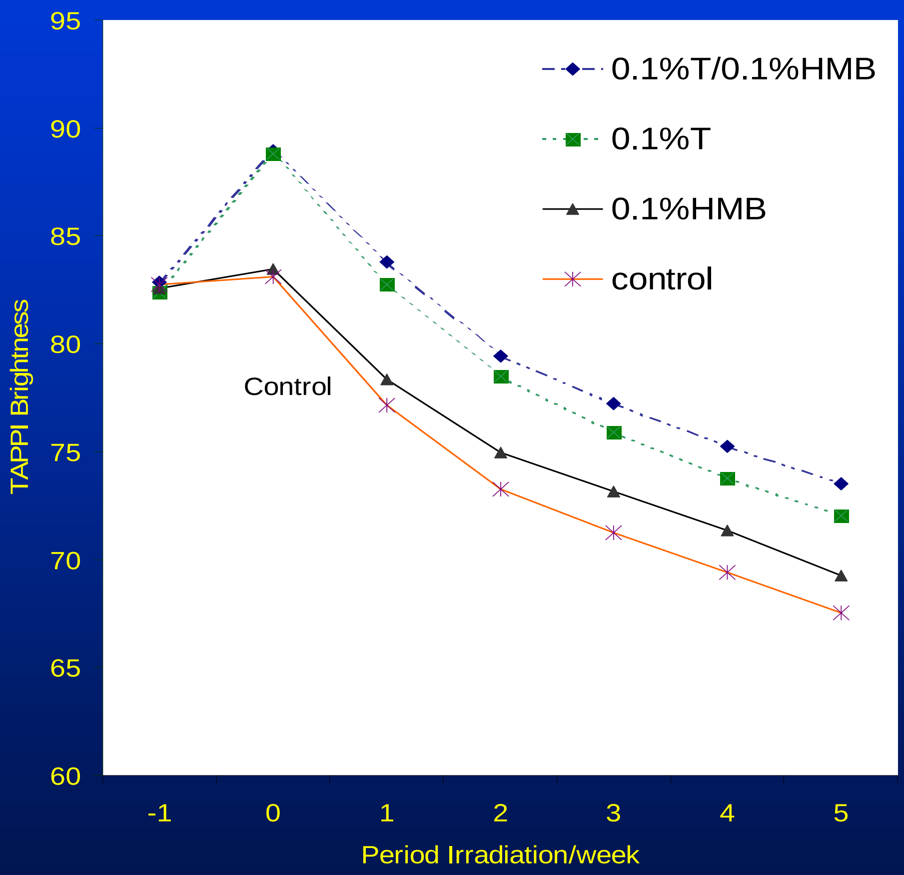
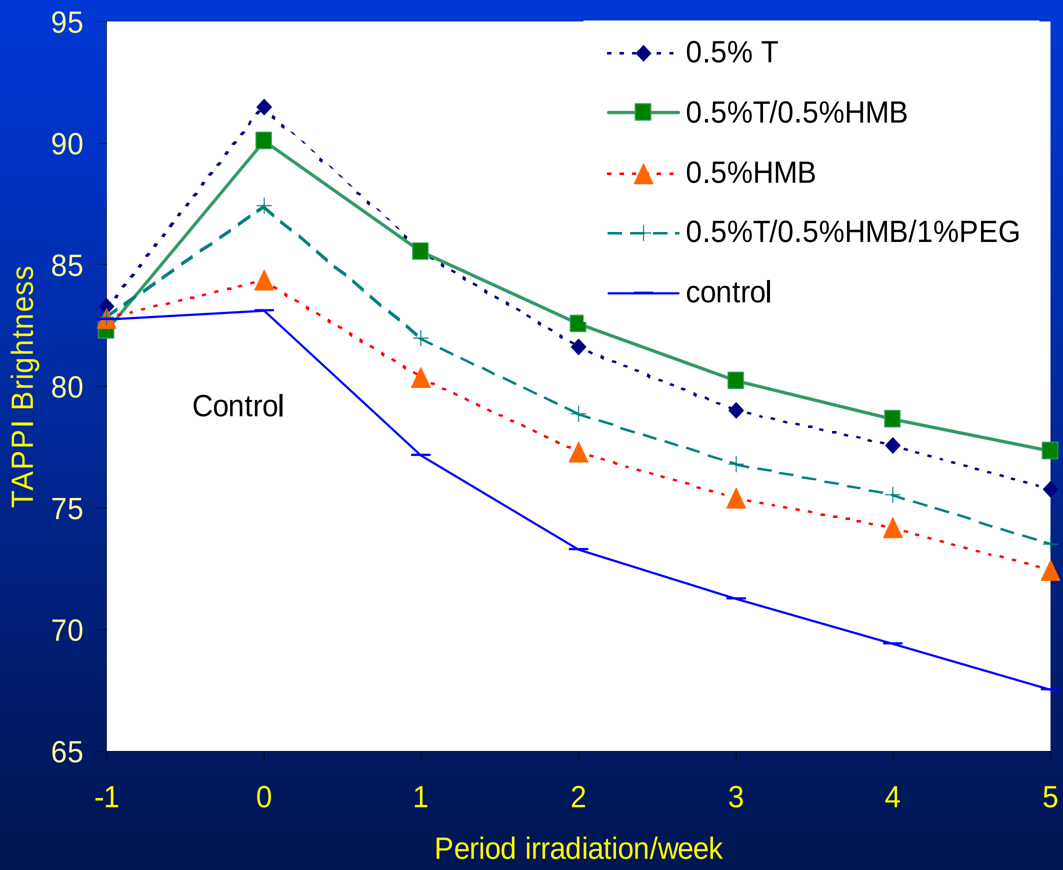
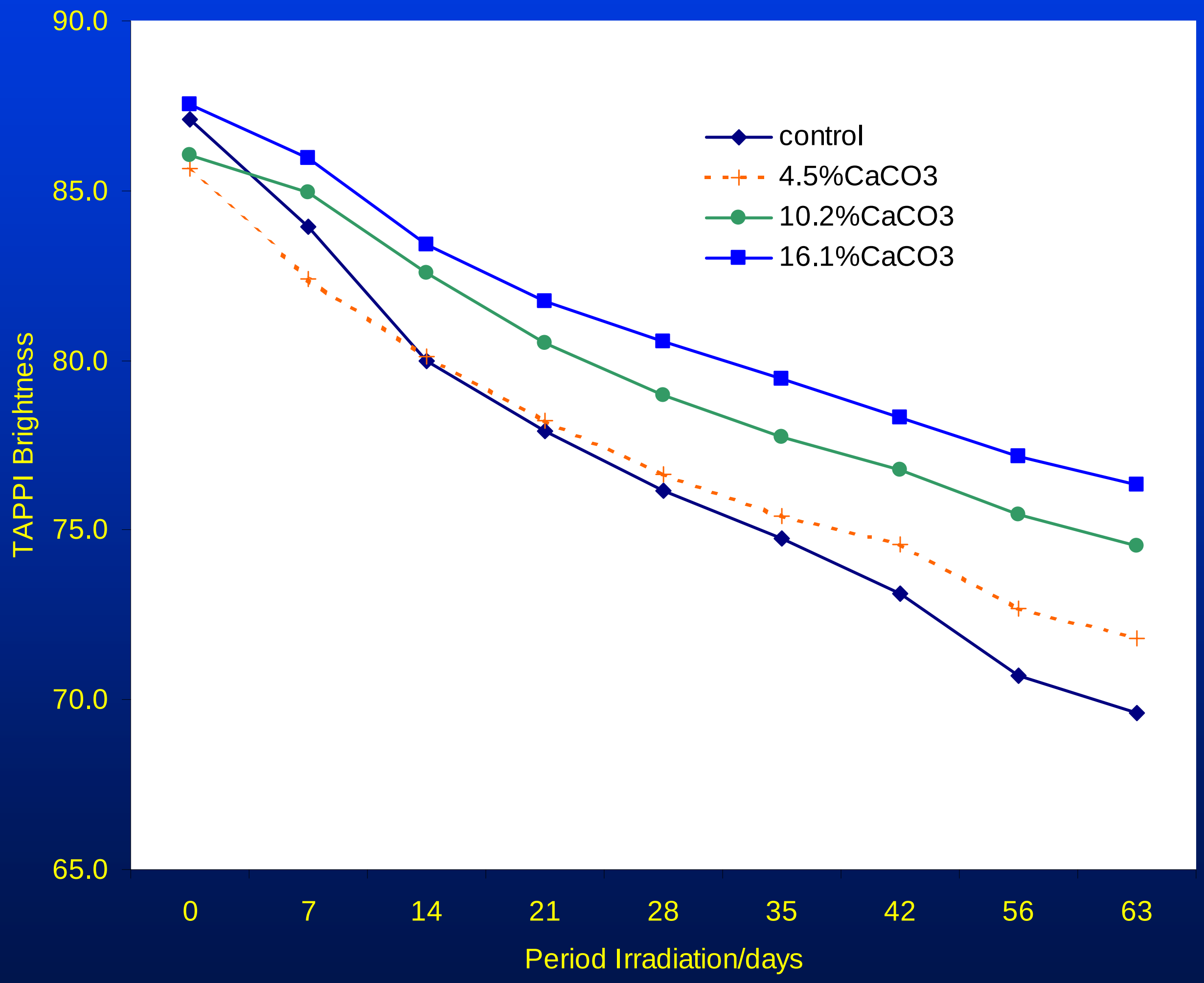


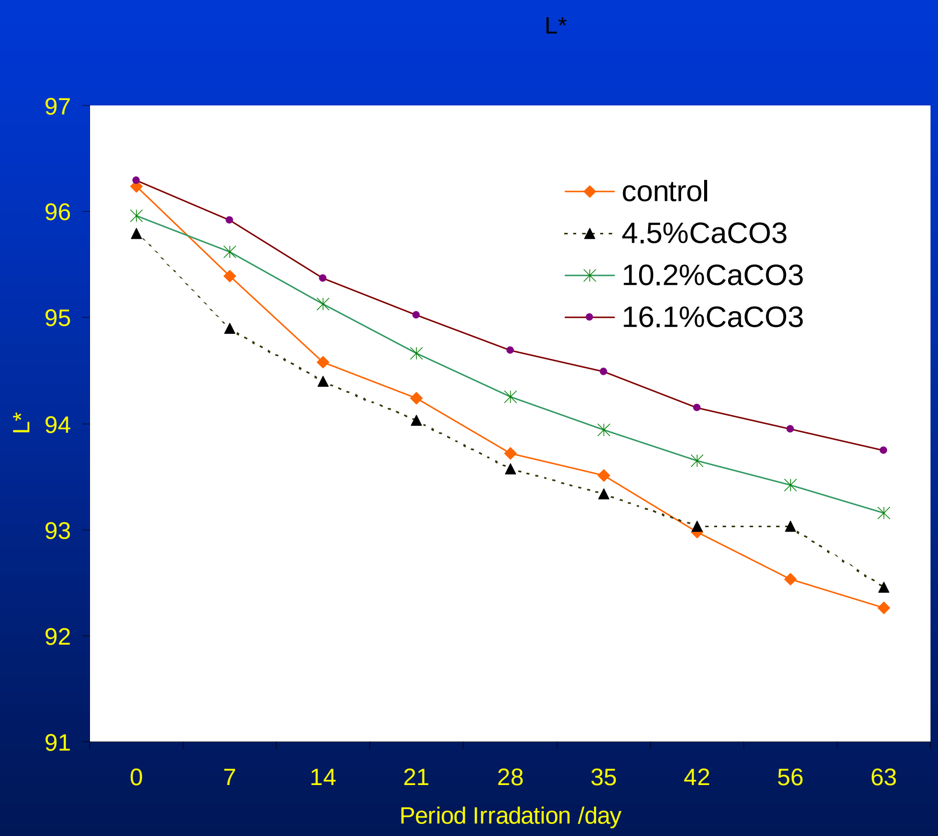


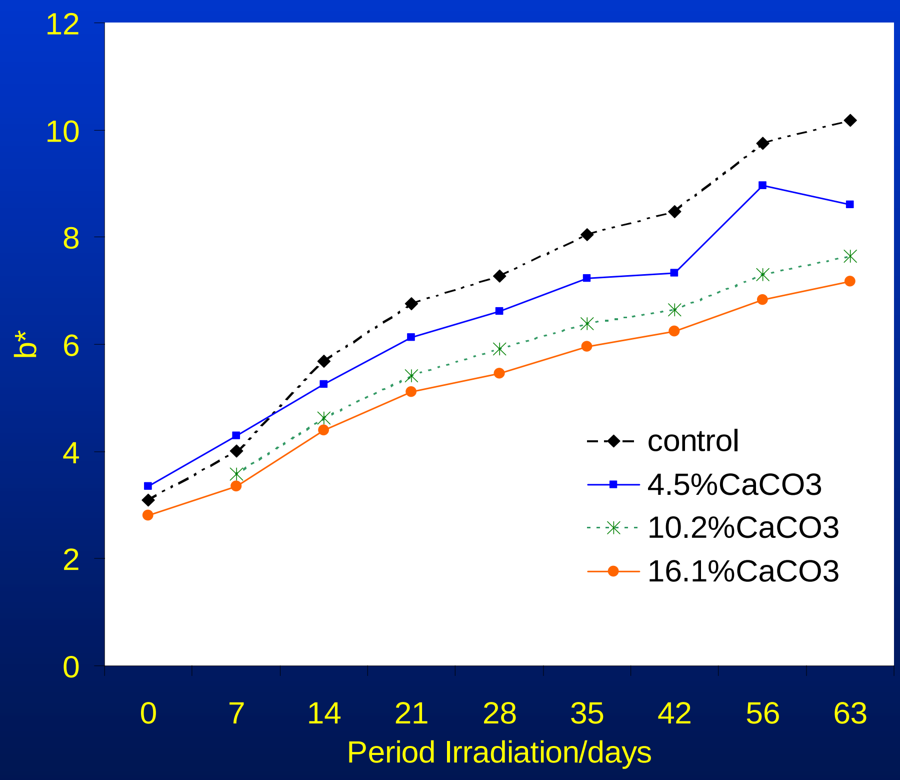
25% HW BCTMP - 75% SW Kraft :$CaCO_3$



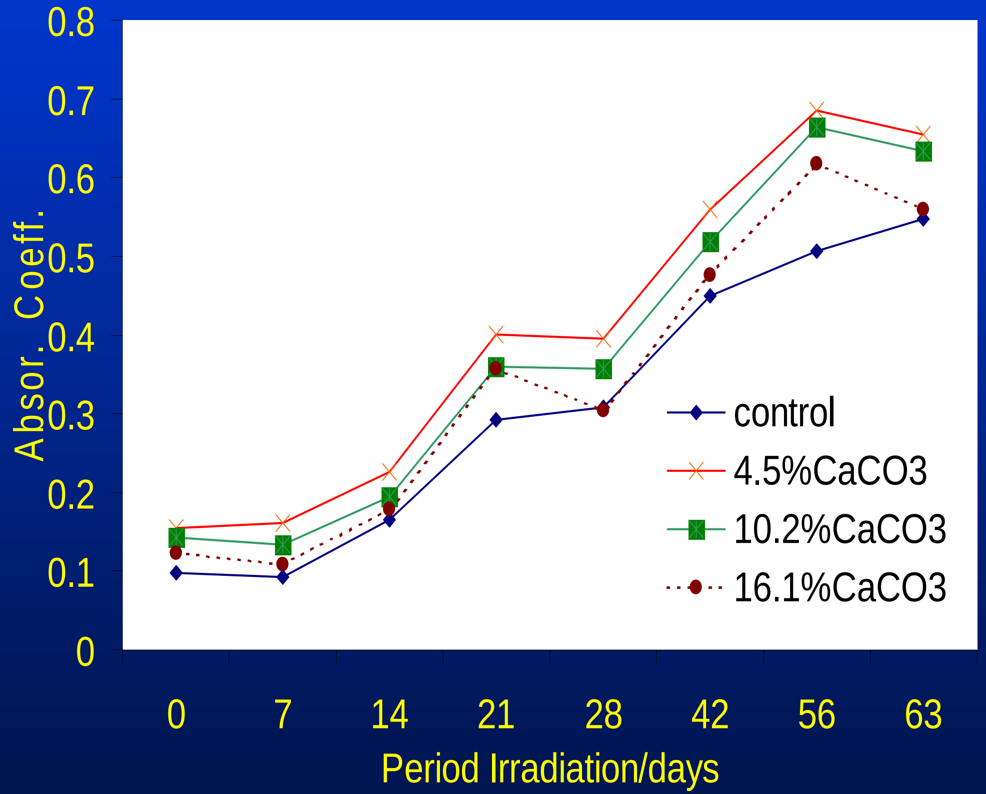
-photoreversion studies employing 0.7 - 1.7% TiO_2 exhibited no photoreversion benefits

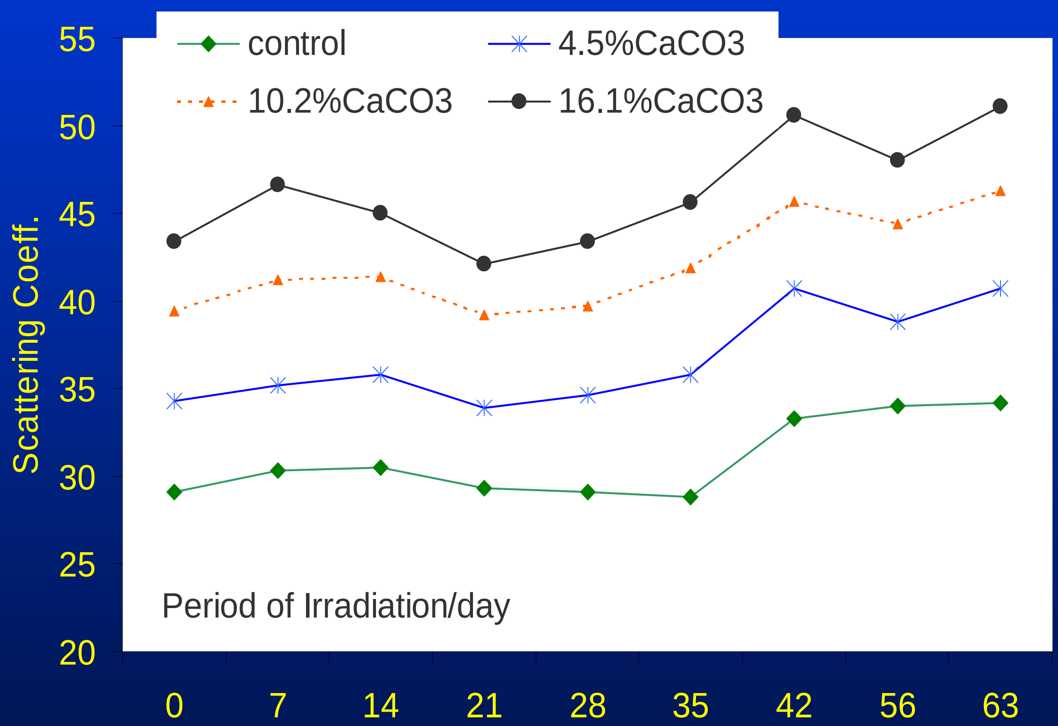
25% HW BCTMP - 75% SW Kraft : L* & b* values for $CaCO_3$



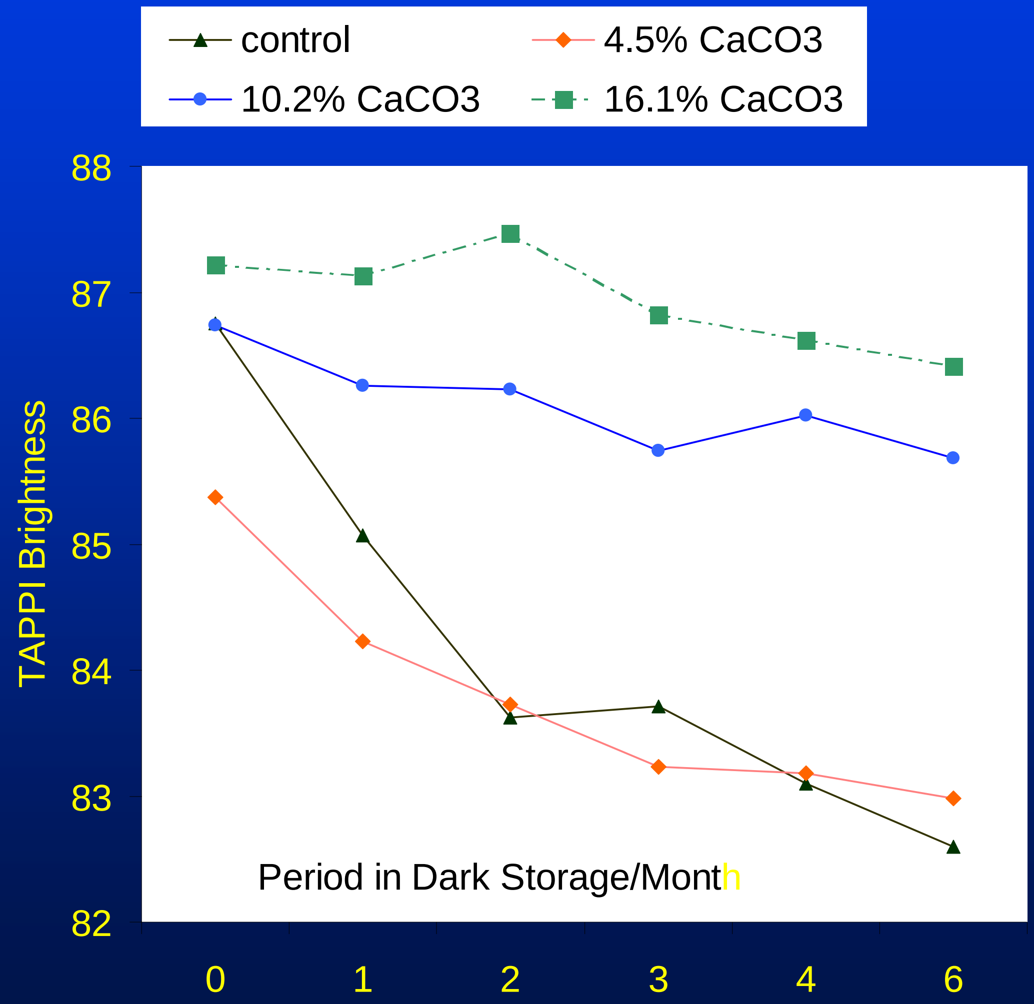


25% HW BCTMP - 75% SW Kraft : Absorption & Scattering Coeff. Values for $CaCO_3$





25% HW BCTMP - 75% SW Kraft : $CaCO_3$ Dark Storage



Conclusions

FWA and $CaCO_3$ provide readily available technologies to retard photoreversion of mechanical pulps

Benzophenone derivatives extend the effect of FWAs for BCTMP

Acetylation studies initiated and studies ongoing to address initial brightness losses