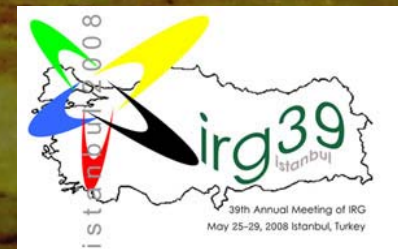


THE EFFECT OF GAMMA RADIATION ON SELECTED WOOD PROPERTIES

Radovan Despot, Associated Prof., Marin Hasan, MSc, Andreas O. Rapp, Prof., Christian Brischke, PhD, Christian R. Welzbacher, PhD



GAMMA RADIATION

The influence of gamma radiation onto wood?

- Gamma radiation change molecular structure in living cells, but also in wood cell walls.
- Treatment of wood by gamma rays causes random break-up in the cellulose chain (Seaman et al. 1952; Kenaga and Cowling 1959).

GAMMA RADIATION

Why gamma radiation?

- high energy, ionising electromagnetic radiation,
- fully penetrate through the irradiated wooden object doing the sterilisation (in the way of ionising molecules or changing their chemical structure in the living cells),
- changed structure of molecules leads to:
 - inexpedient function or
 - death of living cells,
- very easy, fast and effective method of sterilisation.

GAMMA RADIATION

Consequences???

- Changes in mechanical properties of wood (especially dynamic) and MOE,
- Changes in natural (biological) durability,
- Suspicion on the changes of hygroscopicity and other physical properties of wood.

THE AIM!

To determine the effect of irradiation intensity on selected wood properties:

- decrease in mass by leaching (dm)
- total amount of water-soluble carbohydrates (TSC),
- maximum swelling (α_{MAX}),
- and the resistance to impact milling (RIM).

MATERIALS AND METHODS

MATERIAL:

- Croatian home-grown Pine sapwood (*Pinus silvestris* L.)
- All specimens were cut out of one log
- Dimensions of specimens (R×T×L: 20×20×10 [mm])
- The dosages of 30, 90 and 150 kGy of gamma radiation were applied (^{60}Co)

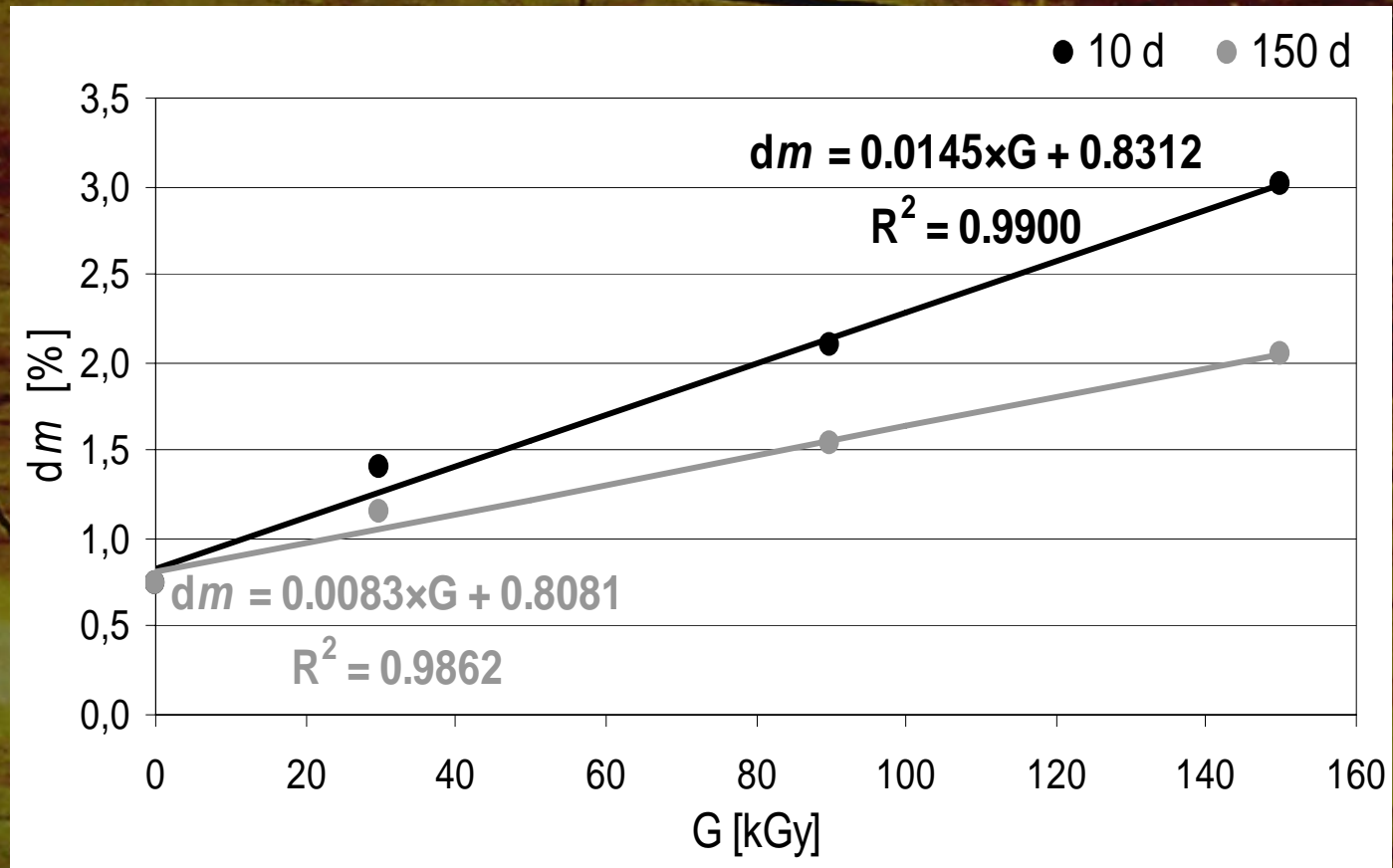
MATERIALS AND METHODS

METHODS:

- **The decrease in mass by leaching**
 - specimens were leached in distilled water at 60°C for 48 h.
 - water was changed every 12 h.
 - dm was determined by weighing of the oven dried specimens before (m_1) and after leaching (m_2),
- **Total amount of water-soluble carbohydrates (TSC)**
 - was determined according to Rapp et al. (2003).
- **Swelling Test**
 - was determined according to Despot et al. (2007)
- **High-Energy Multiple Impact (HEMI)-Test**
 - was done according to Rapp et al. (2006).

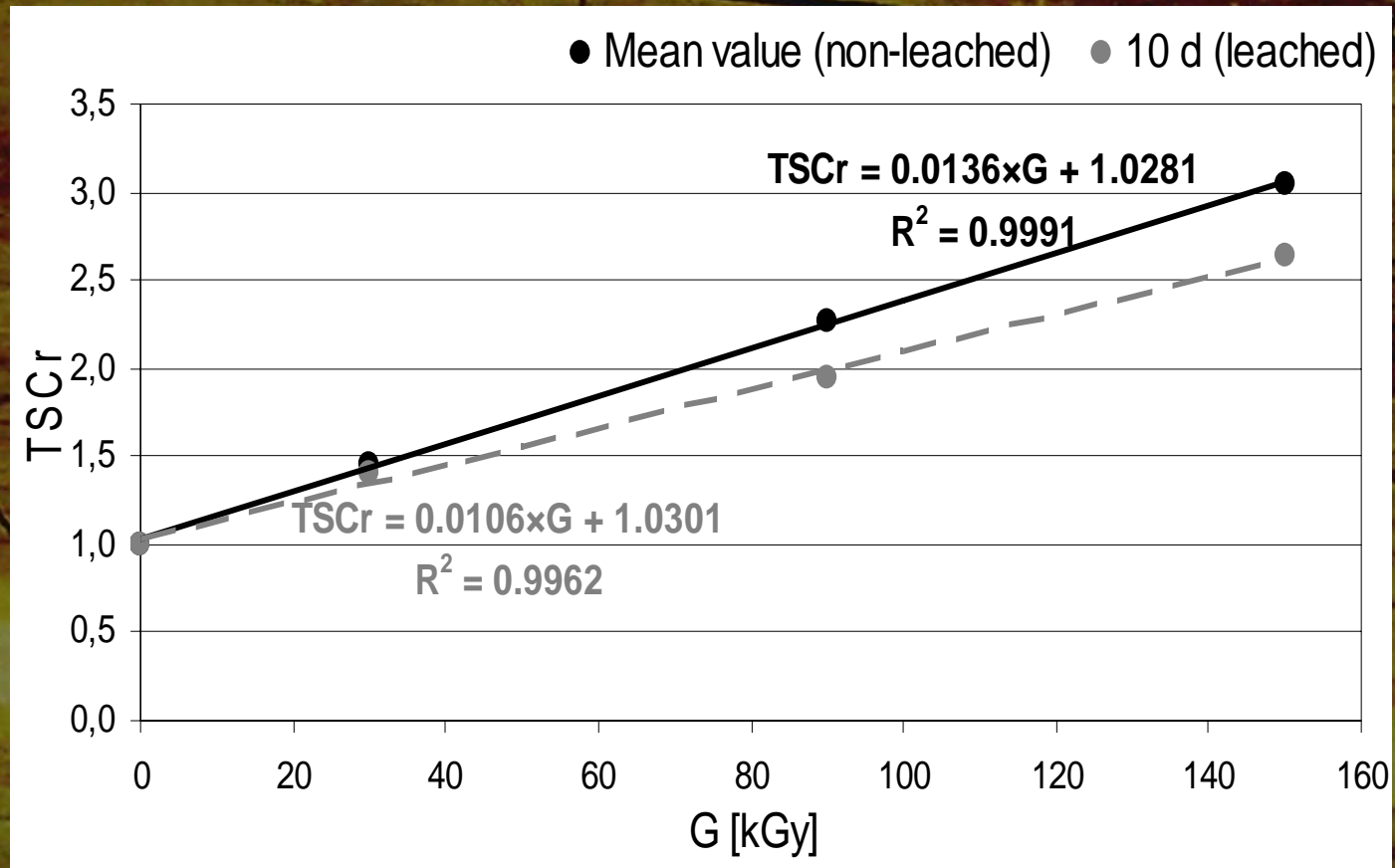
RESULTS

Decrease in mass during leaching, dm



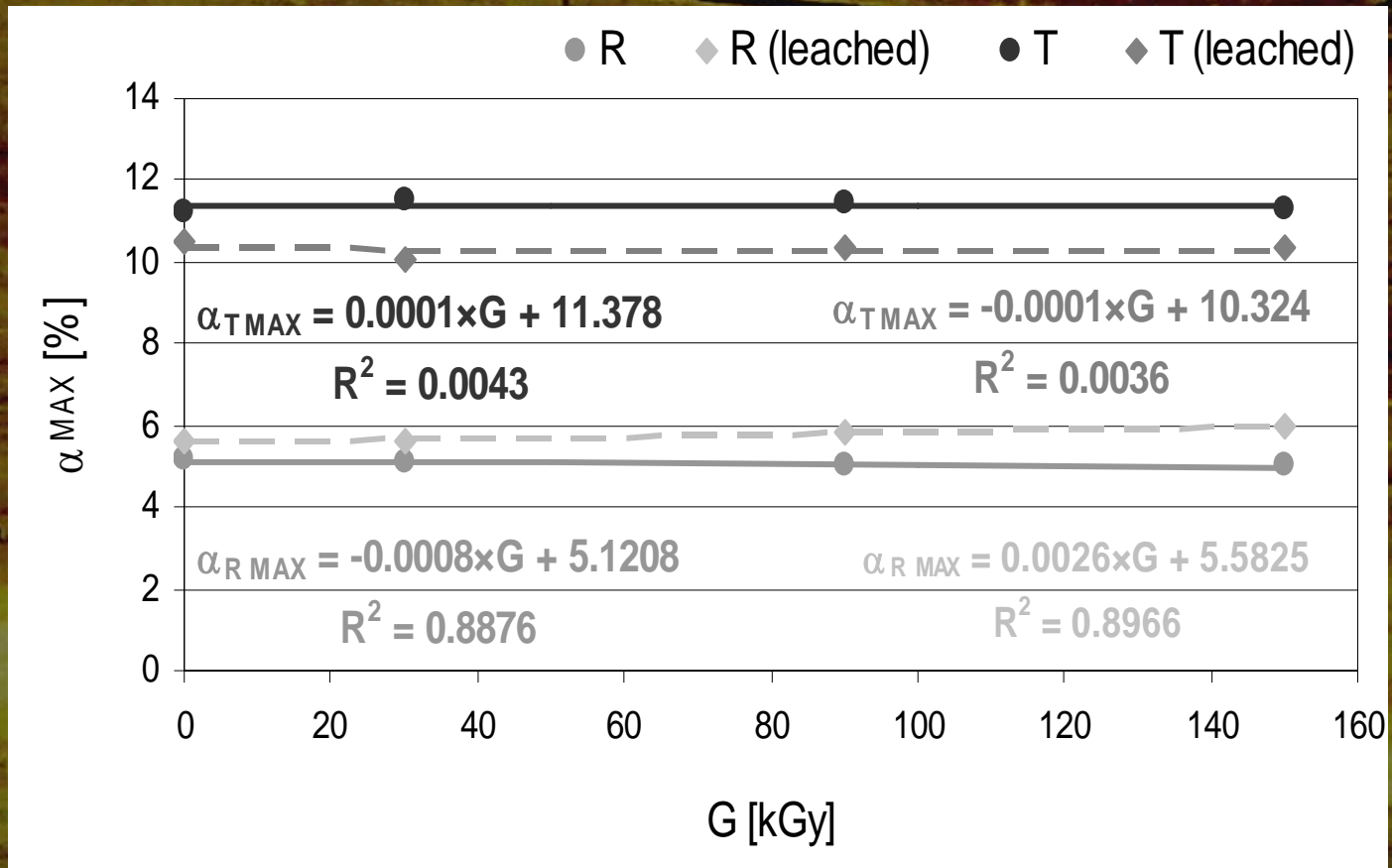
RESULTS

Total amount of water-soluble carbohydrates, TSC



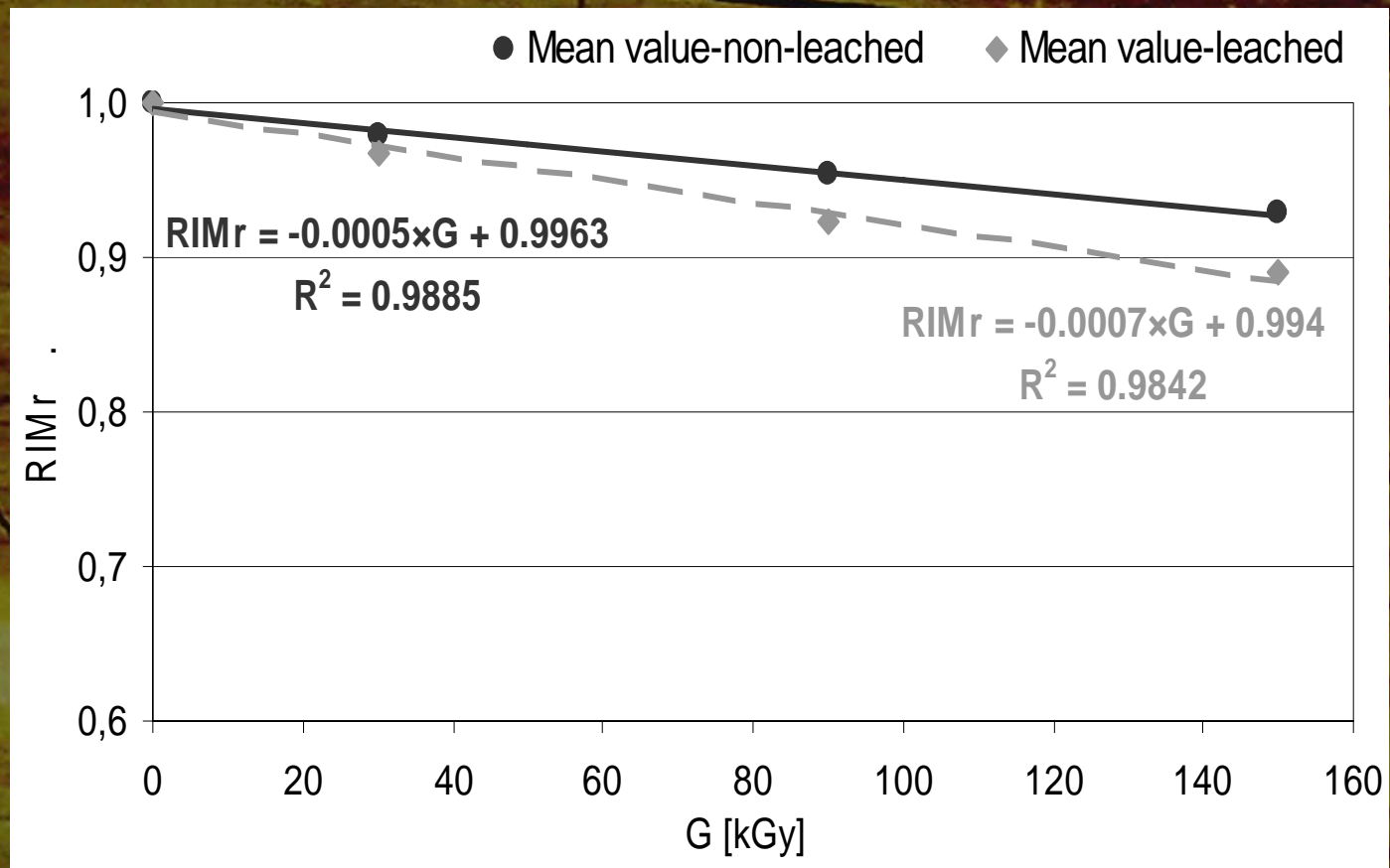
RESULTS

Maximum swelling, α_{MAX}



RESULTS

Resistance to impact milling, RIMr



CONCLUSIONS

- Gamma radiation at a level of 30 to 150 kGy causes irreversible and permanent changes in chemical and mechanical properties of wood.
- The HEMI test method proved to be suitable to determine small but significant changes in strength and brittleness caused by gamma radiation.
- With increasing radiation dosage the total amount of water-soluble carbohydrates increases linearly, while the maximum swelling seems to be unchanged.
- Elapsed time after gamma radiation did not influence maximum swelling, resistance to impact milling and total water soluble carbohydrates.

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The image features the text "Thanks for your attention" in a large, white, 3D block font. The text is slanted upwards from left to right. It is set against a background of a green, textured surface with several prominent, dark, jagged cracks that run across the frame. The lighting on the 3D text creates a sense of depth and shadow.

Thanks for your attention

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