Commercialization of Vitamin D Enhanced Mushrooms by UV Light Treatment

Mushrooms Canada

Guelph Food Technology Centre

Vitamin D2 Conversion

UV light

Ergosterol → Vitamin D2

(pro-vitamin D2) (ergocalciferol)

Vitamin D2 conversion is a function of UV light energy

Daily Reference Intake

	FDA	Health Canada
Infants, children, men and women aged 19-50	200 IU	5µg (200IU)
Men and women aged 51-70	400 IU	10µg (400IU)
Men and women over 70	600 IU	15µg (600IU)

Target

Vitamin D 400 IU/one serving fresh mushroom

or

Vitamin D 10µg/100g fresh mushroom

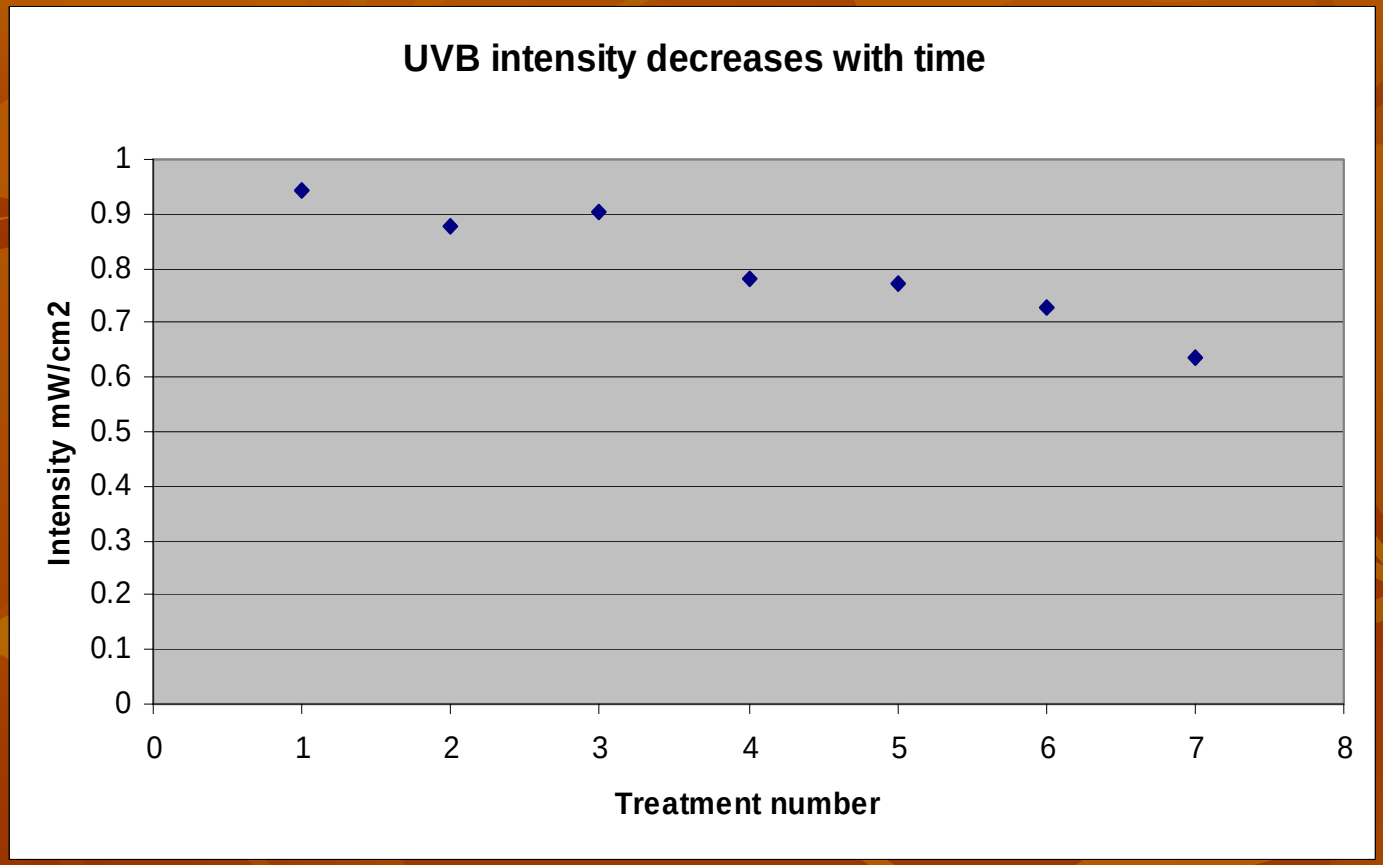
Variables

- Variety of mushrooms (agaricus, shiitake, oyster, enoki)
- UV energy / unit area (dosage)
  - Intensity (wattage of bulbs, number of bulbs, distance)
  - Exposure time

$$\text{Dosage } (J/cm^2) = \text{Intensity } (mW/cm^2)) \times \text{Time } (s)$$

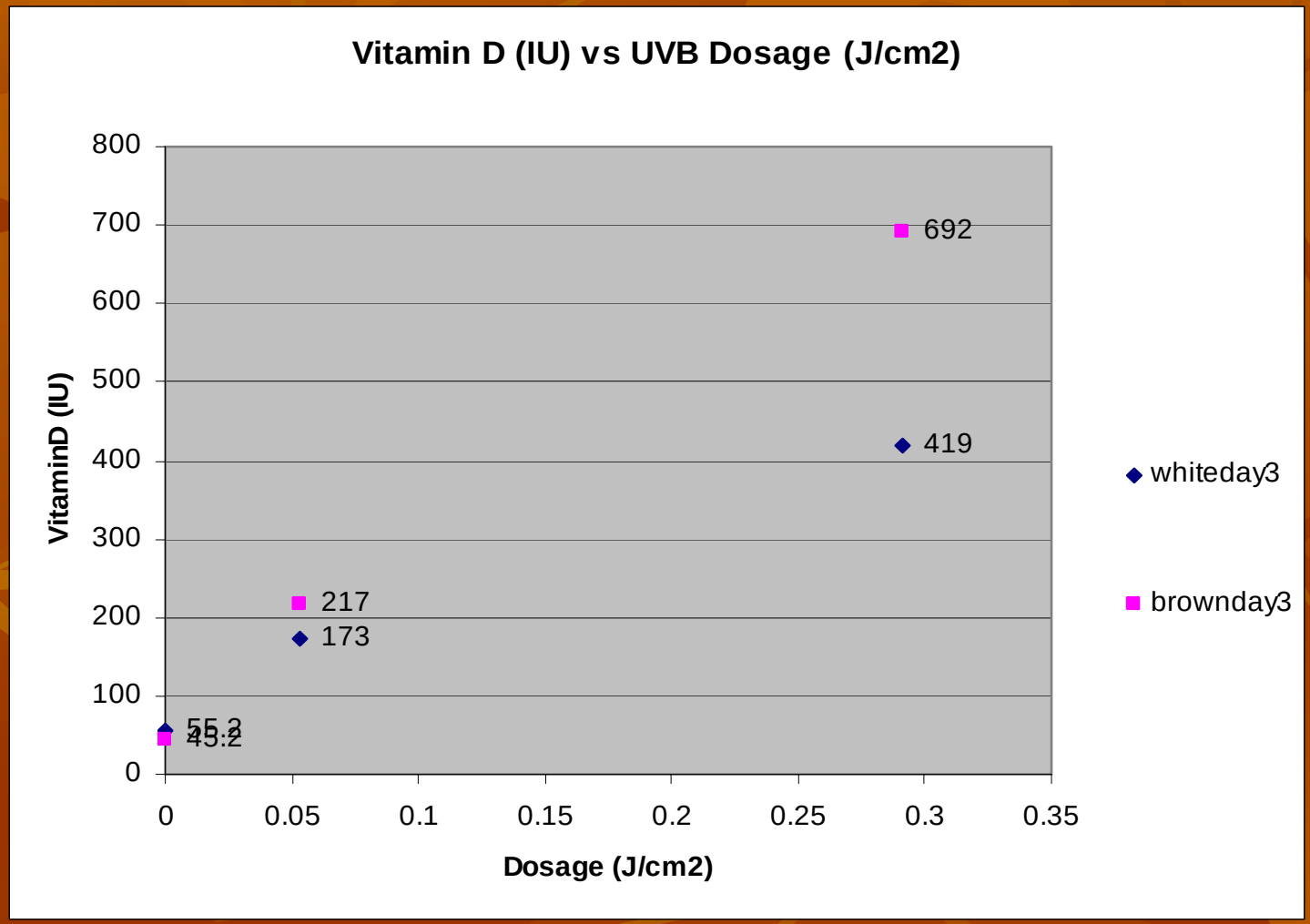
UVB Treatment Facility at GFTC

UVB Intensity Decay



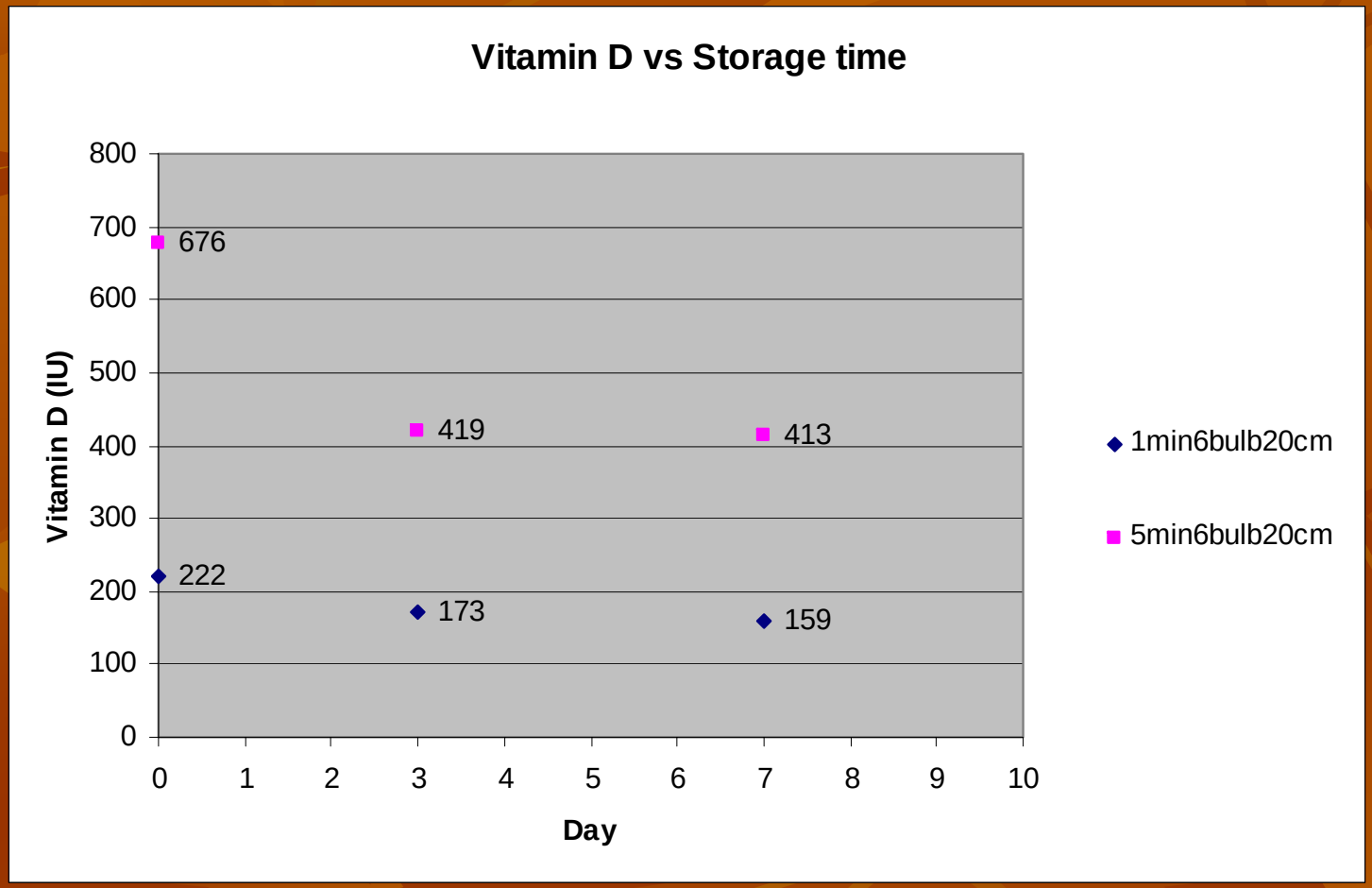
- Solutions
  - Commercial equipment which delivers consistent UV light intensity
  - Automatic UV intensity compensation

Vitamin D vs UVB dosage

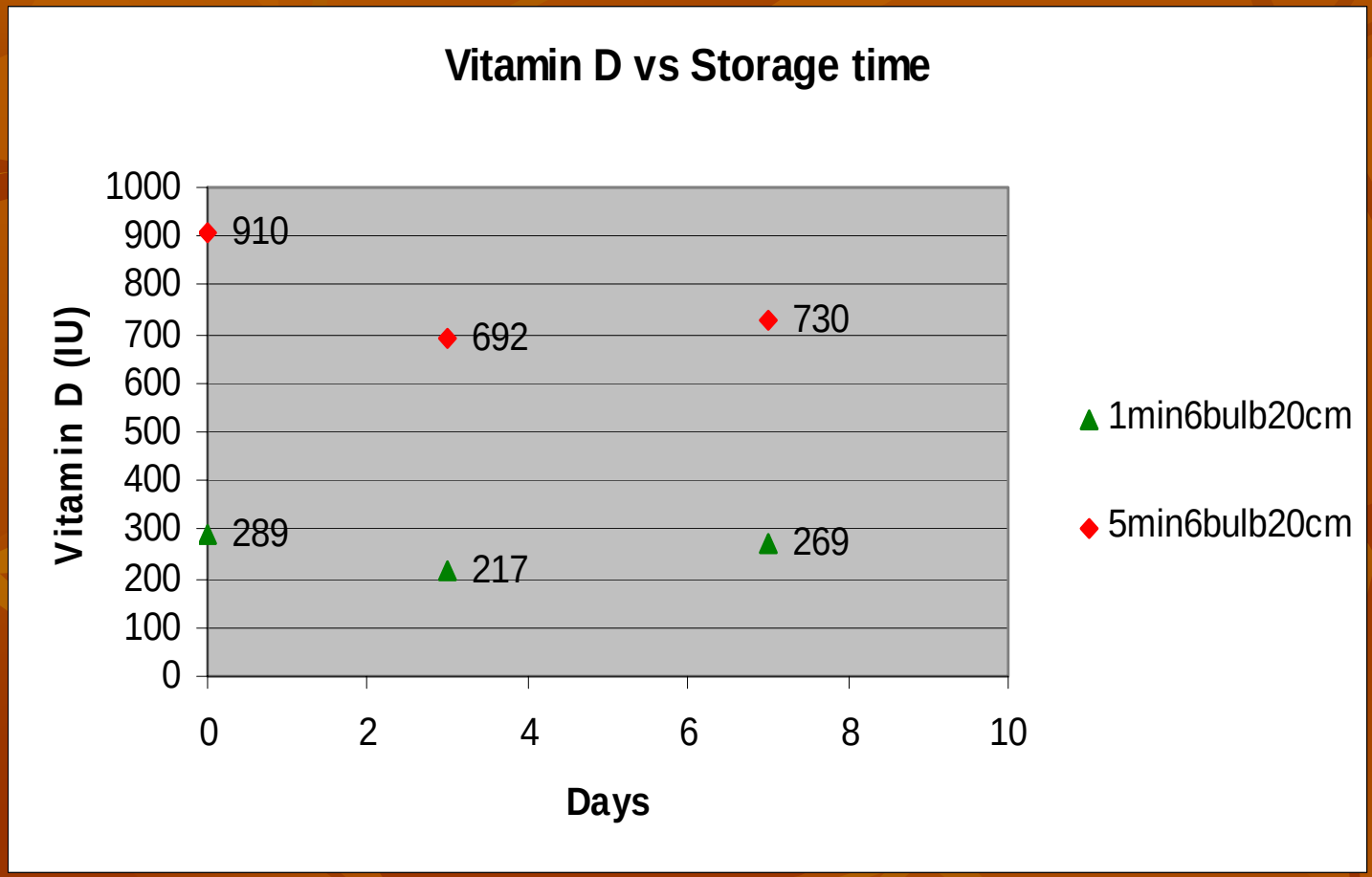


- Day 3 might represent the product at the retail level

White Button Mushroom



Brown Crimini Mushroom



Shelf life studies – white mushroom Day 1

Shelf life studies – white mushroom Day 3

Shelf life studies – white mushroom Day 7

No significant difference in appearance between the control and the treated

Shelf life studies – brown mushroom Day 1

Shelf life studies – brown mushroom Day 3

Shelf life studies – brown mushroom Day 7

No significant difference in appearance between the control and the treated

Sensory Study

- Triangle sensory evaluation on Day 2
- Control vs UVB treated
- Twelve panellists participated the triangle test. Eight out of twelve couldn’t tell the difference between the control and the treated. Four out of twelve picked the right sample. Statistically, there is 1/3 chance that the panellist will get the right answer even they can’t taste the difference.
- sensory panel indicates there is no significant difference between the control and the treated.

Microbial test - white mushroom

	White control	White treated 5m6b20cm
APC	4.30E+04	8.60E+04
E. Coli	<1.0E+01	<1.0E+01
mold	1.60E+03	1.95E+03
yeast	5.00E+01	<5.0E+01
S. aureus	<2.5E+01	<2.5E+01
Listeria sp.	neg	neg
Salm. Sp.	neg	neg

Same order of magnitude between the control and the treated

Microbial test - brown mushroom

	Brown control	Brown treated 1m6b20cm
APC	> 2.5E+05	> 2.5E+05
E. Coli	<1.0E+01	<1.0E+01
mold	9.0E+02	3.0E+02
yeast	5.00E+01	<5.0E+01
S. aureus	<2.5E+01	<2.5E+01
Listeria sp.	neg	neg
Salm. Sp.	neg	neg

Same order of magnitude between the control and the treated

Medallion Labs for Vitamin D Analysis

The frozen mushroom samples were used. Fractions of the internal standard, D2 and D3 are collected using a semi-preparative normal phase HPLC column. The fractions are then concentrated, and the total amount of Vitamin is determined using reverse-phase HPLC with UV detection

Conclusions

- The target level of vitamin D (400IU/serving) can be achieved by relatively low dosage of UVB exposure for both white and brown mushrooms (approx. 0.2 -0.3 J/cm^2)
- This UVB dosage can be applied at relatively low intensity (0.8 – 1.2 mW/cm^2) and in reasonable length of time (2-3 min)
- Vitamin D decreases during storage but stabilizes at 60-80% of original level after a week
- No significant quality difference between the control and the treated
- No detectable sensory difference
- UVB intensity decays with time