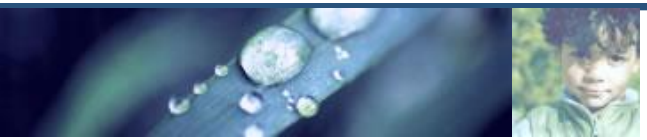


Irradiation Testing – Spices and Other Foods

Peter Brown

Eurofins (LSW)

Overview

- Legislation and general background
- Nature of testing for irradiation and overview of the techniques available
- Irradiation testing for spices and herbs
- The TL technique
- The PSL technique
- Future developments in PSL

Background and Legislative Aspects to Food Irradiation

- First experiments in use of ionising radiation to treat food in 1920s
- Destroys pathogens
- Reduces spoilage organisms
- Delays ripening of fruit
- Prevents sprouting of vegetables (e.g. potatoes and onions)

UK Legislation

- First set of UK regulations: The Food (Control of Irradiation) Regulations 1990
- Replaced by The Food Irradiation (England) Regulations 2009 – In force July 2009

Food Irradiation (England) Regulations 2009

- Fruit
- Vegetables
- Cereals
- Bulbs and tubers
- Dried aromatic herbs, spices and vegetable seasonings
- Fish and shell fish
- Poultry

Food Irradiation (England) Regulations 2009

- Maintains the concept of “properly irradiated food” which is food in one of the permitted categories which has not been “over –irradiated”
- Lists the establishments in UK, EC and Third Countries approved to irradiate food for sale in or importation into the UK

- Advisory Committee on Irradiated and Novel Foods:
  “Ionising radiation up to an overall average dose of 10kGy, correctly applied, provides an efficacious food preservation treatment which will not lead to a significant change in the natural radioactivity of the food or prejudice the safety and wholesomeness of the food”

Concerns of the general public(?):

- They are very mistrustful of processes they do not understand
- Irradiated food is “unnatural” (?)
- Irradiated food is “radioactive food” (?) (Chernobyl)
- Distrust of information given out by government & government agencies (?)

- Food Irradiation Background and Development of Government Policy – MAFF April 1996
- Food Irradiation – The Facts – FSA February 2001
- An Evidence Review of Public Attitudes to Emerging Food Technologies – Social Science Research Unit FSA March 2009

The Nature of Testing for Evidence of Food Irradiation

- There is no single technique that can be described as the ‘technique of choice’ for testing in this area. Very matrix dependent.

Luminescence Techniques

- TL (MAFF V27 and EN 1788:2001)
- PSL (EN 13751:2002)

Radiolytic Chemicals (Cyclobutanones)

- 2- alkylcyclobutanones are characteristic cyclic by-products formed during the irradiation of triglycerides.
- Can be measured by GC-MS
- Method Published as EN 1785:2003

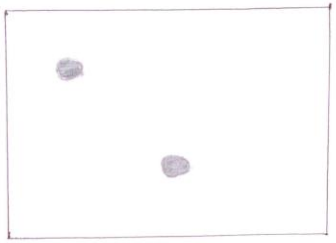
Electron Spin Resonance (ESR)

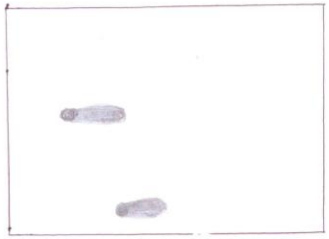
- When food is irradiated free radicals are generated within that food.
- ESR can be used to detect these free radicals
- Applicable to foods which are hard/dry or contain a hard dry component
- Foods containing bone
- Shells of crustaceans /beans/seeds /dried fruit/spices

DNA Techniques

- DNA is vulnerable to irradiation treatment so irradiation-induced changes in the DNA molecule can be used as a tool to detect irradiation treatment of foods
- Comet Assay

Comet assay





- Frozen veal not irradiated
- Frozen veal irradiated to 3kGy

Microbiological methods

- Elimination or reduction of micro-organisms – methods based on this.
- LAL/GNB
- DEFT/APC
- In both cases compare count of living **and** dead cells to count of living cells
- Screening methods

Testing of Spices for Evidence of Irradiation Treatment

- One of the 7 permitted categories

- Spices often have high bacterial loading
- Can be used in foods which receive minimal further processing
- Previous chemical sterilisation agents (e.g. ethylene oxide) now banned

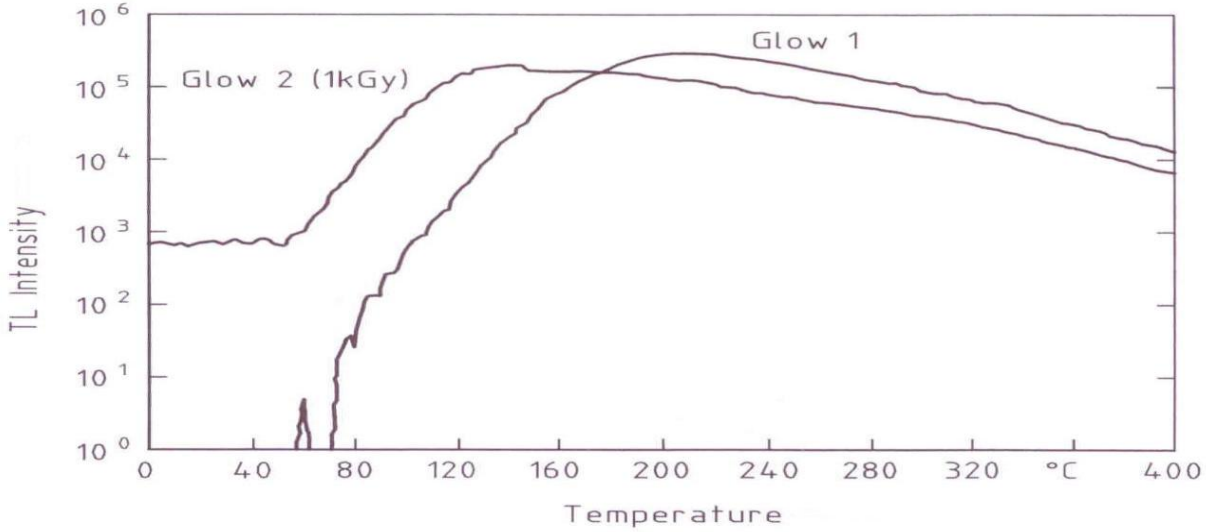
Thermoluminescence

- Inorganic materials (such as silicates) can store energy by charge trapping processes as a result of exposure to ionising radiation.
- The stored energy can remain present for many years
- The stored energy can be released by application of heat to produce a measurable luminescence

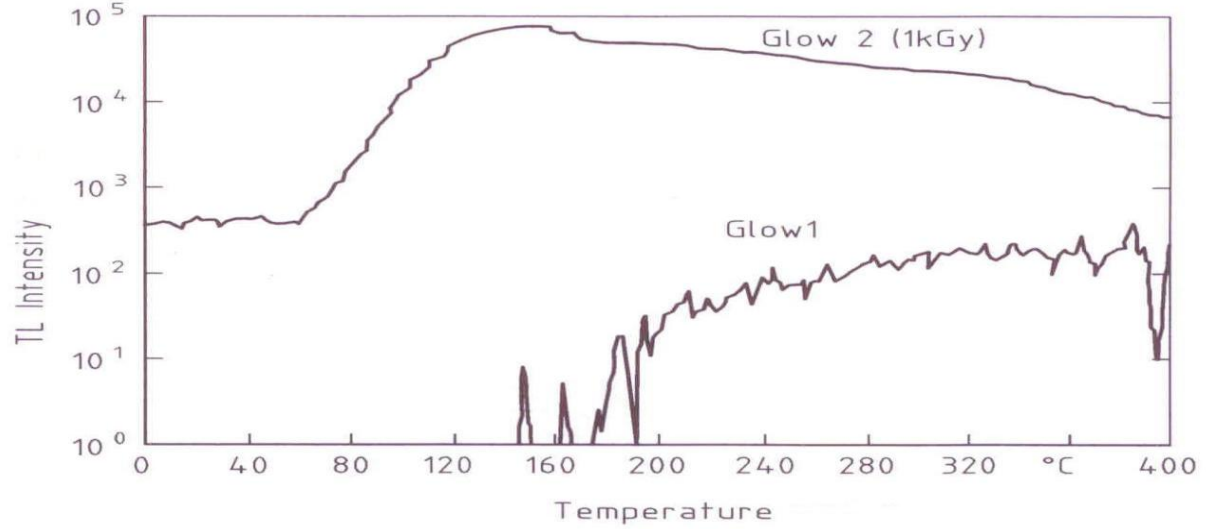
TL Procedure

- Isolation of minerals by wet sieving and density separation
- Minerals onto steel disc
- Heat over a specified temperature range
- Measure energy released (Glow 1)
- Irradiate separated minerals to 1kGy
- Re-read after irradiation (Glow 2)

Glow curves



TL glow curves from an irradiated sample



TL glow curves from an unirradiated sample

Glow Ratios

- The glow intensity is measured in a selected region of the curve (usually around 220^{o}C to 240^{o}C) for G1 & G2
- The ratio for G1 to G2 calculated
- For wholly irradiated food the ratio is usually greater than 0.1

Glow Shape

- The shape of the G1 glow curve
- Minerals from irradiated foods show a maximum in the region 150^{o}C to 250^{o}C
- Low level natural radioactivity results in curve maxima at higher regions on the curve (300^{o}C or above)

Photostimulated Luminescence

- Uses light to stimulate the release of irradiation derived energy in mineral matter associated with food samples
- Light is infra-red from LEDs
- No requirement to separate minerals from the food
- Can be a sensitive technique
- We confirm PSL results indicating irradiation by use of TL

Calibrated PSL

- Carry out initial PSL testing
- Have sample irradiated
- Re test irradiated sample by PSL

Applicability of PSL

- As well as herbs and spices :
- Shellfish
- Dried vegetables and Seasonings (noodle snack products etc.)
- Food supplements
- Bee products (propalis, ‘bee pollen’)
- Cheese powder

Future Developments for PSL

- Proficiency Testing scheme
- Optimisation of PSL for low sensitivity samples (eg Food supplements)

Thank you for your attention.