National Institute of Research and Development
for Potato and Sugar Beet Brasov

"New challenges in research on potato, sugar beet and medicinal plants, in term of climatic, global and economic changes"

IRRADIATION ADVANTAGES OF SPICES, MEDICINAL PLANTS AND DRIED FOOD PLANTS

F.V. EDU*, A. MARCULESCU*, C. BADARAU**

* FACULTY OF FOOD AND TOURISM BRASOV
**NIRDPSB BRASOV

- 2010 -

Food irradiation implies a controlled exposure of foodstuff, in specific conditions, to a source of ionizing radiation of well known energy.

In the case of radiation treatement of spices, medicinal and food dried plants, the goal is to reduce the microbian population, ensuring their hygienic quality.

The amount of energy reportedly to the product' s mass is called the dose and is measured 1 Gray (Gy) = 1 Joule/ kg.
For food radiation processing, the dose is measured in kGy (1,000 Gy).

There are beeing used three energy levels:

- **low doses (up to 1 kGy);**
- **medium doses (1 – 10 kGy) - the improvement of hygienic quality of spices (10 kGy);**
- **high doses (above 10 kGy).**

The ionization of food and agricultural products is attending the BIOICIDE effects:

- ✓ **the insectice effect (grains, tobacco);**
- ✓ **the fungicide effect (spices, dried fruits and vegetables, coffe);**
- ✓ **the bactericide effect, as to eliminate pathogen bacteria (Salmonella, E. coli).**

Generally, the microbiological quality of spices and herbs reflects the hygienic situations of the regions where production takes place and also to their handling.

Most dried food ingredients of vegetable origin may contain large numbers of microorganisms that may cause spoilage or defects in the composite food to which they are added, or more rarely could cause foodborne diseases.

A wide range of bacterial and fungal species has been identified in spices and herbs.
Bacterial counts in this products vary from 10^4 – 10^7/ gram.

- **Although the microbial content of spices vary greatly, in general, black pepper, turmeric, paprika, chili and tyme are the most contaminated spices.**

Bacteria like *Bacillus cereus* and *Clostridium perfringens* are frequently found in spices, but usually in low numbers.

- **However, in extreme cases, *B. cereus* counts up to 10^5 CFU/ g have been found.**

Several other *Bacillus* spp., that are opportunistic pathogens, are more frequently isolated from spices. Since their spores may survive cooking, ingredients harbouring these spores must be considered as a potential health hazard.

Salmonella **has been found, although infrequently, in a variety of spices.**

However, its presence is of great concern, when spices are used in food that are consumed raw or when the spices are added to food after cooking.

Mold counts of spices and herbs may reach to 10^5 CFU/ g level, and also a high incidence of toxigenic molds have been found.

The mold genra *Penicillium* and *Aspergilus* are common, and hence, mycotoxins may be present.

Medicinal plants have an abundant and varied microflora.

➢Roman chamomile, lemon balm and peppermint showed bacterial loads that ranged 10^5 to 10^7 CFU/ g fresh weight.

❖ Some herbal products sold as „health food" also proved to be of dubious microbial quality.

The application of Good Hygienic Practices (GHP) and the Hazard Analysis of Critical Control Points (HACCP) concepts are of importance in the field of dried ingredients and should consider the whole process, including production in the countries of origin.

However, importers, lack direct control in exporting countries and this diminishes CCP opportunities.
Therefore, the need for microbial decontamination treatements for spices and herbs is an important question.

Until the early 1980s, the most widely used method to destroy microorganisms in dried food ingredients was fumigation with ethylene oxide.

A number of alternative technologies have been developed for decontaminating dried food ingredients.

- **However, none of them match the applicability of treatement with ionizing radiation, beause of their low antimicrobial efficiency, changes in flavour and color, loss of functional properties.**

Irradiation has a very strong antimicrobial effect. Radiation doses of 3 – 10 kGy reduce the total aerobic viable cell counts even in highly contaminated spices and other dry ingredients to bellow 10^3 – 10^4 CFU/ g.

✓ **Recontamination can be prevented because irradiation can be applied to products as a terminal treatement, in their final packaging.**

✓ **Total carotenoids in ground paprika were unaffected by treatement with 5 kGy during storage for 250 days.**

✓ **The antioxidant properties of spices reportedly remain unaltered by radiation decontamination treatements.**

✓ **No loss of vitamin C was observed in onion powder, even when a 20 kGy dose was applied.**

Sensory analysis and practical food applications indicate that at 4 – 10 kGy, doses sufficient high for „pasteurization”, no significant differences exist between irradiated samples and controls, from an overwelming majority of spices and herbs.

✓ **The spoilage of white bread has been shown to decrease when irradiated flour is used to make the bread.**

✓ **Doses around 10 kGy reduced to negligible levels the microbial load of several industrial enzyme preparations, without affecting enzymatic activity.**

✓ **The application of radiation treatement for „hygienization" of powdered natural food colorants has also been reported.**

Radiation decontamination of dehydrated vegetables reduces product hardness and increases water absorption capacity.

- **However, certain vegetables (asparagus, mushrooms and onions) may undergo browning.**

- **Irradiation of cocoa powder was repported to adversly affect the flavor of the final product.**

Some factors support the economic feasibility and industrial use of radiation decontamination of dried food ingredients:

- **it is easy to automate and ca be applied as a continuous process;**
- **it can be applied to materials in their final packaging;**
- **the technology can be applied the whole year;**
- **the demand for decontamination dried ingredients is increasing and therefore achieving high microbilogical quality products is very important.**

The cost of irradiation was greater than that of fumigation, but the advantages of irradiation were considered to offset the increase in price

Irradiation of spices on a commercial scale is practiced in more than 20 countries

Irradiation is a recognized method for reducing the microbial load of dried food ingredients.
Legal clearances have been granted in many countries for irradiation of spices and herbs

THANK YOU!!!