

SESSION 1: IMPROVING QUALITY of LIFE

PANEL 1.2: Nuclear technologies in industry, material sciences and beyond



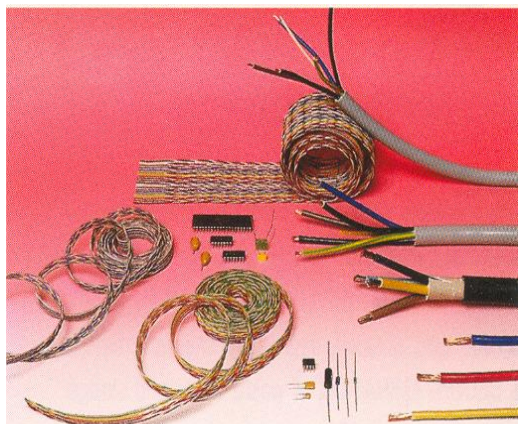
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Researcher, Nuclear and Energy Research Institute (IPEN)

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Radiation Technology: From High Performance Materials, To Preserving Cultural Heritage



Pablo Vasquez
Nuclear and Energy Research Institute– IPEN
São Paulo - Brazil



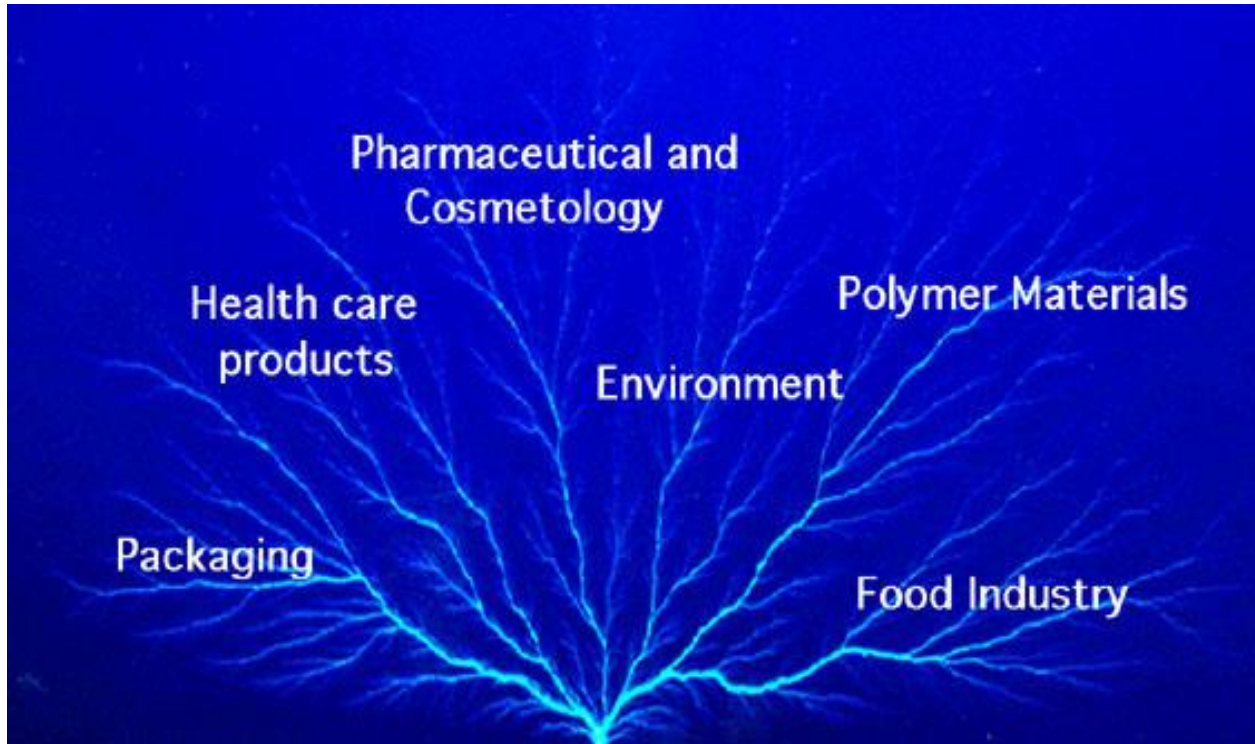
Ministerial Conference on Nuclear Science and Technology: Addressing Current and Emerging Development Challenges

28–30 November 2018, Vienna, Austria



Radiation Technologies are present in daily life

People around the world are benefiting from the use of radiation technologies



Radiation Processing

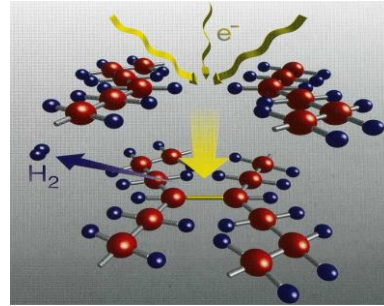
- Practical application of radiation chemistry;
- Use of the energy of ionizing radiation - high energy - (gamma, electrons and X-ray) by introducing biological, physical and chemical effects in the irradiated product.

<https://www.youtube.com/watch?v=ePiNdzWjoWM>



Challenges and advantages of Radiation Processing

Radiation Crosslinking for production of polymer products



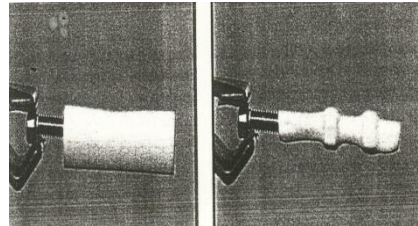
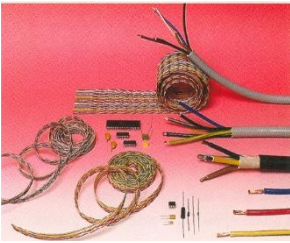
Radiation crosslinked wire
heat resistant, abrasion resistant, high mechanical properties



- Production of new materials with special characteristics;
 - Less chemicals (e.g. organic solvents) are needed;
 - Less energy consumption;
 - Less environment pollution ;
 - Economically favourable technologies;
- Standardized process control methods;

Rubber vulcanization Foamed polymers

Wire and cable insulations Heat shrinkable products:

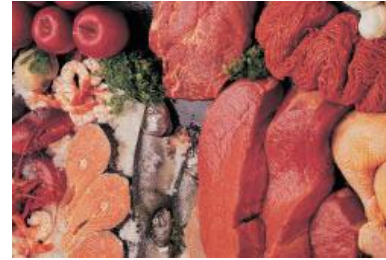


Food Irradiation

- to decrease food losses during storage (20-30 % of food production is lost due to pests, insects, bacteria, fungi);
- to decrease microbial contamination (pathogens, parasites result in food-borne diseases);
- to avoid infection it looks to be the best solution;



Human Tissues and prothesis Sterilization



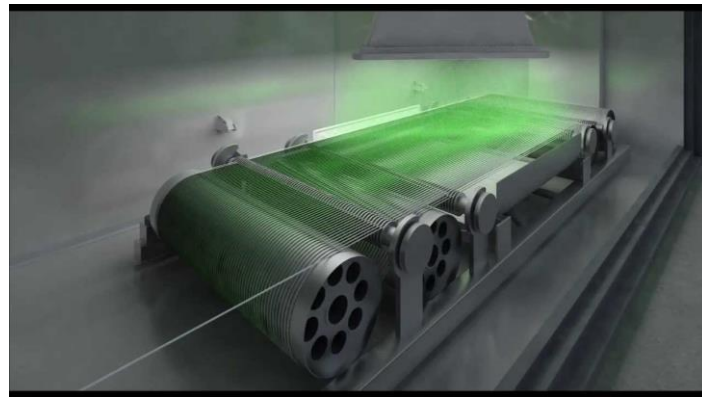
- Based on microbiological effect:
- Single use medical devices (60 % of production)
- food packaging materials;
- food for astronauts and for hospitals;

Radiation Sterilization



Surface Coating

- Simultaneous radiation polymerization and crosslinking of monomer and oligomer molecules on the surface of e.g. wood, metal, paper, ceramics, film resulting in a homogeneous layer in room temperature without using solvents
- Industries: printing, furniture, building, etc.
- New: low energy curing of pigmented coatings on metal coil (energy saving).

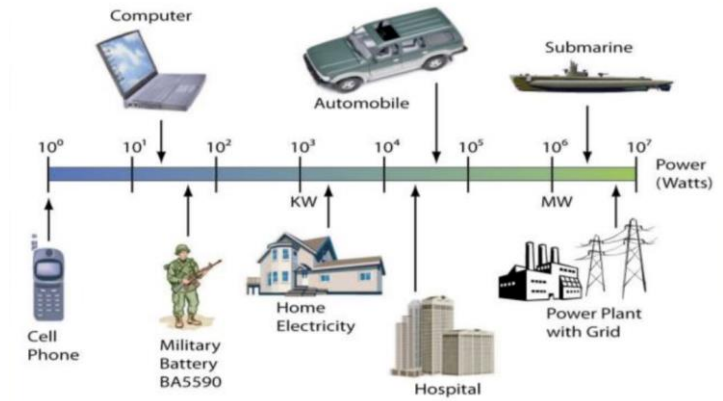


Potential Fuel Cell Applications



Source: Agency for Natural Resources and Energy

Fuel Cell Power Spectrum



Radiation Grafting

Monomer or oligomer function group is connected to a polymer molecule by ionizing radiation resulting in new product of new characteristics.

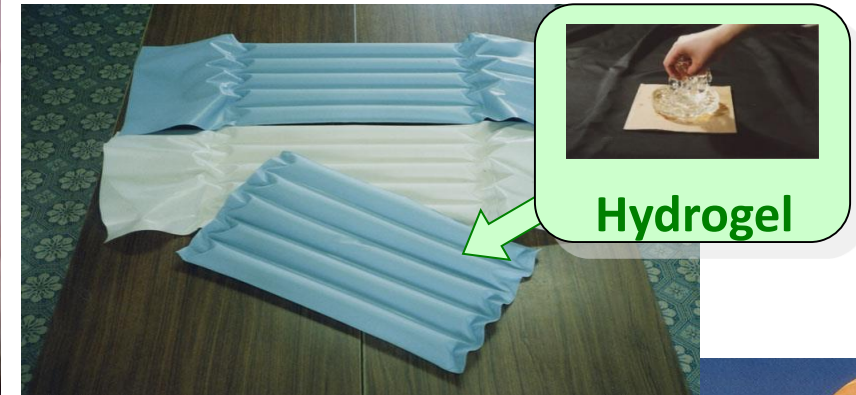
Application fields:

- packaging materials (PE coated Al foil)
- textile products (better colourization)
- health care products (increased biocompatibility)
- battery separators
- FUEL CELL MEMBRANES GRAFTED USING IONIZING RADIATION



Release Technologies

- Biomedical products – production of hydrogels: (hydrophilic polymers: PVP, PVA) -Wound dress and prevention of bed sore.
- Radiation treatment of postal packages (anthrax).
- Composite materials – e.g. SiC ($^{\circ}\text{C}$) for space research; carbon fibers for e.g. car industry;
- Nanogels for controlled release drug-delivery systems;
- Surface decontamination of packaging (aseptic) materials
- Radiation degradation: natural (cellulose, polysaccharides) and artificial (teflon) polymers to smaller molecular weight parts of smaller viscosity: - viscose industry (less chemicals and energy requirement); paper industry; ink production (from teflon waste); cellulose containing waste to produce, animal food; agriculture (chitin e.g.)



Environmental Protection Technologies

Waste water and drinking water treatment:

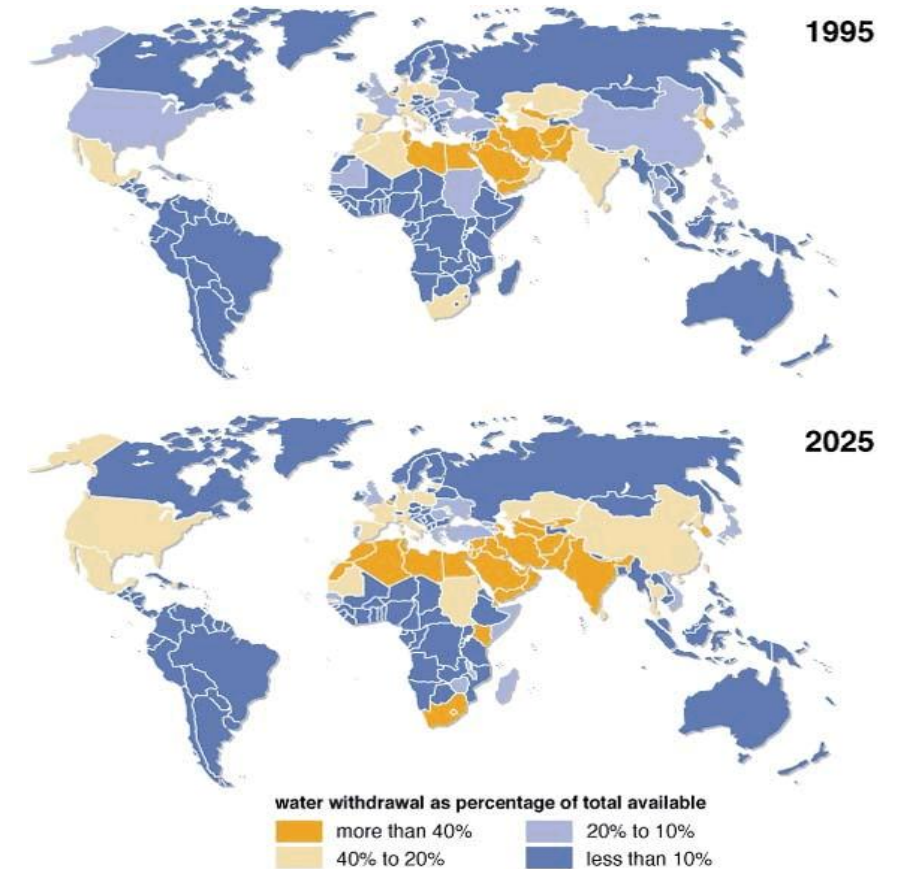
Remove impurities of biological (pathogens) and/or of industrial origin (organic compounds);

Advantages:

- on-line technology;
- no chemical contamination;
- combined treatment is possible (chlorination, ozone, filtration);

Industries:

- Paper production and textile industry;
- Commune waste water;



Environmental Protection Technologies

Sludge treatment:

Utilization of irradiated sludge (5 – 10 kGy) as fertilizer in agriculture, if its heavy metal content is negligible.
On-line procedure.

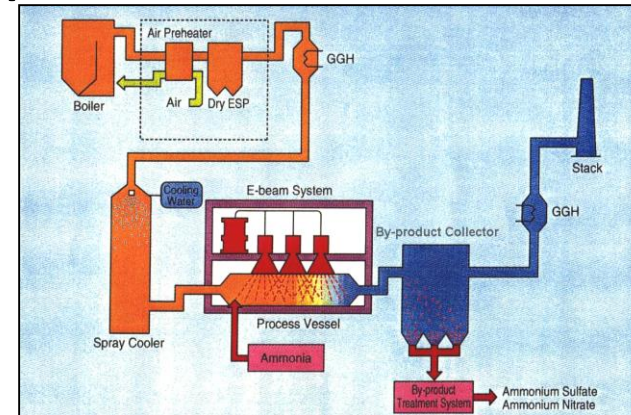
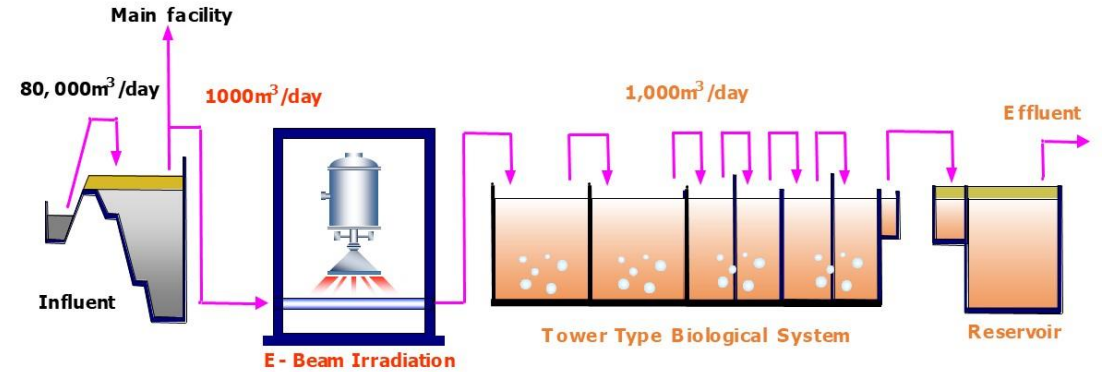
Flue gas treatment:

Coal and oil based power stations emit sulphur and nitrogen containing gases, resulting in „acidic rain”.
Responsible also for the formation of smog and green house effect.

SO₂ (~ 95 %) and NO_x (~ 80 %) removal.

NH₃ addition to produce fertilizers.

Use of low energy accelerators.



Cultural Heritage artefacts and archived materials disinfection and consolidation



<https://www.iaea.org/newscenter/news/culture-meets-nuclear-science-in-brazil>



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Institucional Notícias

22/09/2015
IPEN inicia processo de higienização do acervo do Museu de Arte de São Paulo

Cerca de 500 obras de arte de Manuel Cordeiro foram levadas para o Irradiador de São Paulo para serem higienizadas.

Contaminação de acervo da FAU-USP

Material chegando ao Irradiador de São Paulo

Co-60: são 60m3 de materiais (Foto: Arquivo IREN)

Institucional Notícias

17/02/2016
CTR-IPEN irradia mais de dois mil documentos do acervo da FAU-USP

Parceria com a FAU faz parte de um amplo acordo de colaboração entre IPEN e USP para a higienização do acervo da FAU-USP.

UNICAMP
 Universidade Estadual de Campinas

Agenda de Eventos
 Assine a Agenda
 Concursos
 Dúvidas na Agenda
 Dúvidas sua tese
 Sala de Imprensa
 Agenda no Facebook
 Siga-nos no Twitter
 Agendas 2003 - 2016



Tecnologia a serviço da sociedade

Trabalho realizado o trabalho de higienização e descontaminação de documentos culturais para diversos municípios paulistas.

Institucional Notícias

13/03/2016
Obras do Metrô são descontaminadas no Irradiador Multipropósito de Cobalto-60 do CTR/IPEN

IPEN tem realizado o trabalho de higienização e descontaminação de obras históricas para o Metrô de São Paulo.

As 11 telas que estão sendo higienizadas no CTR/IPEN estão instaladas na Linha 1 do Metrô

As obras de arte do Centro Museu Geológico do Instituto Geológico (IG) em parceria com o Instituto de Pesquisas Energéticas e Nucleares (IPEN) receberam o tratamento de higienização e descontaminação no Irradiador Multipropósito de Cobalto-60 do CTR/IPEN.



BIBLIOTECA DO IPEN passa a ser por irradiação

Os livros da Biblioteca do IPEN estão sendo higienizados e descontaminados.

Parceria com Ipen previne infecção do acervo da Biblioteca por materiais doados

Esta edição, projeto de preservação e como proceder em caso de acidentes.



Irradiação para memória e bens culturais

Documentos da época do Império brasileiro foram irradiados no IREN.

Thanks!

IEB recebe acervo que ajuda a entender melhor o Brasil

Instituto recebe doação do acervo do geógrafo pernambucano Manoel Correia de Andrade, que faz análise profunda dos problemas socioeconômicos e insurreções ao longo do século 20.

Acervo do SDO passa por desinfecção no IPEN

O SDO (Serviço de Documentação Científica) da FAPESP passou por um processo de higienização e desinfecção no Irradiador Multipropósito de Cobalto-60 do CTR/IPEN.

CIÊNCIA PELA ARTE CONSERVAÇÃO DA OBRA "A ESCULTURA DE JOSÉ BENTO"

Pinacoteca de São Paulo

Inscreva-se e participe Curso de Orientação Bibliográfica

Convidamos, em especial, os alunos do quinto ano.

Data: 30 de abril de 2015
 Horário: das 14h às 17h
 Local: Auditório do 1º andar - Prédio Histórico
 Inscrições: hbfs@usp.br, saubib@usp.br ou 3111-4053



Material Conference on Nuclear Science and Technology: Addressing Emerging Development Challenges

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